

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS

In Cooperation with the Department of Conservation and Development of New Jersey

SOIL SURVEY
OF
SALEM AREA, NEW JERSEY

BY

R. T. AVON BURKE, in Charge, and JAMES THORP
U. S. Department of Agriculture
and W. G. SELTZER, Department of Conservation
and Development of New Jersey



*This number is the final and last Soil Survey Report
for the Year 1923*

Beginning with the 1923 Series, Soil Survey Reports will be issued separately. These reports of the individual areas will be sent to libraries as soon as they are available and should be filed, preserved, and ultimately bound to take the place of the bound volumes of the Field Operations which have previously been supplied by the department. The reports for each year will be consecutively numbered, the last report for a particular year bearing the conspicuous notice: "This number is the final and last Soil Survey Report for the Year 192-."



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AREA SURVEYED

The Salem area is in southwestern New Jersey. Its southern extremity borders Delaware Bay. The survey covered all the area mapped on Atlas Sheets Nos. 30 and 34 of the New Jersey Geological Survey and includes nearly all of Salem County, about one-third of Gloucester County, and about one-fourth of Cumberland County. The total area is 527 square miles or 337,280 acres. Salem area is roughly semicircular in shape. The outline along the river and bay is irregular, but the eastern edge is a straight, unbroken line extending north and south for a distance of about $42\frac{1}{2}$ miles, the greatest length of the area. Its greatest width, approximately through the center of the area in an east and west direction, is about $19\frac{1}{2}$ miles.

This area is one of smooth relief and low elevation. The relief ranges from almost flat to undulating or slightly rolling, and the altitude varies from sea level to more than 150 feet above. The area slopes toward Delaware River, and the surface is broken by the ramifications of a fairly well developed drainage system. The highest elevation is in the east-central part of the area on the western slope of the divide between the drainage systems of the Delaware and Maurice Rivers. Subordinate but well-defined extensions of the higher uplands lie between some of the larger streams. Such extensions occur between Raccoon and Oldmans Creeks, between Raccoon and Mantua Creeks, and between Oldmans and Salem Creeks.

The highest uplands range from 100 to 150 feet above sea level, but at points east of Whiglane and at Jefferson an altitude of 166 feet is attained. In this section, the headwaters of the larger streams are gradually cutting farther and farther back into the uplands and are deepening their channels. The slope to the stream channels is generally more steep near the headwaters, the adjacent uplands becoming flatter toward the outlet. In most places the upland level is only a few feet above the water of the streams along the lower courses, before the stream debouches on the tidal flats. The streams become more sluggish as they approach the tidal areas and are generally bordered by widening strips of mucky swamp land.

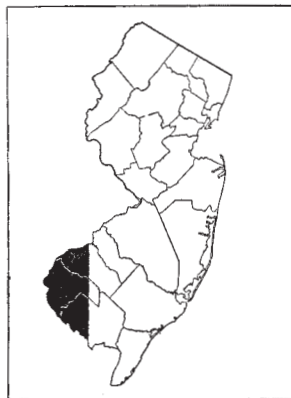


FIGURE 50.—Sketch map showing location of the Salem area, N. J.

Tidal flats are common along Delaware River and Delaware Bay but are more common at the mouth of the river and near the bay where the width in some places exceeds 3 miles. Conspicuous tidal flats extend well into the uplands along Mantua, Salem, Alloway, and Cohansey Creeks.

Drainage of the Salem area is effected by Delaware River and its tributaries. Most of the larger creeks are navigable by vessels of light draft and are utilized for the transportation of farm products and other merchandise. Although the uplands as a whole are well drained, there are many imperfectly drained flats and depressions. There are, however, no large areas of swamp land other than the strips immediately bordering the streams. Most of the poorly drained areas between the uplands proper and the tidal flats are being gradually reclaimed by the use of tile drains and ditches.

On the uplands good water is obtained from wells from 20 to 100 feet deep, but some difficulty is experienced in reaching the water level in the region where the Keyport soils prevail. At one place water lay below the 400-foot depth.

One of the earliest colonies in this area was established by the Swedes in 1637, at Swedesboro. The Dutch from the New York Colony under Governor Stuyvesant took possession of this settlement a short time after its establishment. In 1642 an attempt was made by the English to settle on Salem Creek, but this settlement lasted less than a year as the county was under the dominion of Sweden. Sweden, however, relinquished all her claims in favor of the Dutch in 1655. In 1664, when the Dutch ceded their claims to them, the English established a colony on Delaware River. In 1747 Cumberland County was formed from a part of Salem County. The early settlers, most of whom came from New England and Long Island, were attracted to the area by the lumbering, agricultural, and maritime possibilities.

In 1920 Gloucester County had a population of 48,224, 71.9 per cent of which was classed as rural. The density of the rural population is 104.5 persons to the square mile. Cumberland County's total population numbers 61,348, of which the rural population makes up 41.6 per cent, with a density of 51.1 persons to the square mile. Salem County has a total population of 36,572, 63.1 per cent of which is classed as rural. The density of the rural population is 67.3 persons to the square mile. A large proportion of the inhabitants are of German, English, Italian, Irish, and Russian extraction.

In 1920 Bridgeton, the county seat of Cumberland County and the largest town in the Salem area, had a population of 14,323. This town is an important manufacturing and industrial center. Salem, which in 1920 had a population of 7,435, is an important commercial center and is the county seat of Salem County. Other towns of importance are Penns Grove, population 6,060; Paulsboro, population 4,352; Swedesboro, population 1,838; and Woodstown, population 1,589. In addition to these, a number of small towns and hamlets are located throughout the area.

The Salem area has excellent transportation facilities. Branches of the West Jersey and Seashore division of the Pennsylvania Railroad system traverse the area, and there are several electric and motor-bus lines. An excellent system of highways serves the area. Nearly every farmhouse has telephone connections, and churches and

schoolhouses are conveniently located. Prior to the building of railroads, most of the farm produce was transported on the waterways, and even now a large quantity of produce, on account of cheapness and convenience, is transported in this manner.

CLIMATE

The climate of the Salem area is temperate and, probably because of the moderating influence of the Atlantic Ocean and the proximity of Delaware Bay and Delaware River, is much milder than the latitude would indicate. There is, however, considerable humidity; the winter cold is very penetrating, and the extreme temperatures in summer are oppressive.

The winter weather is more variable than that of the other seasons, as it is usually characterized by mild weather with recurrent cold periods from three to six days apart. The changes are commonly marked by rain or snow. The snowfall is generally light. The average snowfall for the three-month period from December to February at Clayton, in Gloucester County, is 19.6 inches and at Bridgeton is 14.8 inches.

The spring months of March, April, and May are also characterized by changeable weather with considerable range in temperature. The relatively high humidity makes the colder weather very disagreeable.

The fall months of September, October, and November have less range in temperature and the weather is more uniform. The weather at this period is exceptionally fine, and winter is approached with a gradual lowering of temperature.

The summer weather is generally pleasant, although there are days that are hot and oppressive. The nights are usually cool, being tempered by ocean breezes.

The precipitation, which is usually adequate for the successful growing of the crops commonly produced, is well distributed throughout the year. Crops are rarely damaged by excessive rainfall or drought, although there are times each year in which the rainfall is more or less than is required. The rains in winter, early spring, and sometimes in late fall are from the east or southeast, but during late spring, summer, and early fall most of the rain comes as thunder-showers from the southwest and west.

The average frost-free season is 172 days at Clayton and 184 days at Bridgeton. The average date of the last killing frost at Clayton is April 27 and at Bridgeton is April 21, and that of the earliest at Clayton is October 16 and at Bridgeton is October 22. The dates of the latest and earliest recorded frosts, respectively, were May 29 and September 23 at Clayton and May 29 and September 22 at Bridgeton.

The following tables give the normal monthly, annual, and seasonal temperature and precipitation as recorded by the Weather Bureau stations at Bridgeton, in the southern part of the Salem area, and at Clayton, in Gloucester County, about 18 miles northeast of Bridgeton. Clayton lies just outside of the Salem area. There is a difference of about 100 feet in elevation between the Bridgeton and Clayton stations, the Bridgeton station being 30 feet above sea level and the Clayton station about 130 feet. This difference may have some effect on the climatic conditions.

1652 FIELD OPERATIONS OF THE BUREAU OF SOILS, 1923

*Normal monthly, seasonal, and annual temperature and precipitation at Bridgeton,
Cumberland County*

[Elevation, 30 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1921)	Total amount for the wettest year (1919)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	36.2	71	-5	3.82	2.27	5.14	3.9
January.....	33.7	74	-8	3.52	2.26	3.81	5.3
February.....	33.7	72	-8	3.82	2.58	3.65	5.6
Winter.....	34.5	74	-8	11.16	7.11	12.60	14.8
March.....	42.3	85	5	4.18	3.42	3.77	3.7
April.....	52.7	93	21	3.52	3.26	3.45	.9
May.....	64.0	98	31	3.84	2.73	5.83	0
Spring.....	53.0	98	5	11.54	9.41	13.05	4.6
June.....	72.1	101	43	3.73	1.85	5.56	0
July.....	76.7	104	49	4.49	3.59	11.38	0
August.....	75.0	104	47	4.59	3.18	8.30	0
Summer.....	74.6	104	43	12.81	8.62	25.24	0
September.....	68.2	99	35	3.31	1.99	1.98	0
October.....	57.4	92	25	3.59	.98	3.54	0
November.....	45.6	80	15	2.80	3.97	3.28	.4
Fall.....	57.1	99	15	9.70	6.94	8.80	.4
Year.....	54.8	104	-8	45.21	32.08	59.69	19.8

*Normal monthly, seasonal, and annual temperature and precipitation at Clayton,
Gloucester County*

[Elevation, 130 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1916)	Total amount for the wettest year (1907)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	34.3	69	-6	3.93	4.89	5.59	5.6
January.....	32.1	74	-12	3.47	1.97	2.55	7.3
February.....	30.7	70	-13	3.58	3.96	2.19	6.7
Winter.....	32.4	74	-13	10.98	10.72	10.33	19.6
March.....	41.7	87	7	3.58	3.82	2.60	3.7
April.....	51.2	94	21	3.48	1.68	4.15	1.7
May.....	61.7	99	31	3.33	2.14	5.18	0
Spring.....	51.5	99	7	10.39	7.54	11.93	5.4
June.....	69.5	101	40	3.67	3.83	6.00	0
July.....	75.0	104	44	4.85	5.65	2.30	0
August.....	73.1	105	46	4.92	.78	5.79	0
Summer.....	72.5	105	40	13.44	10.26	14.09	0
September.....	66.8	98	32	3.44	1.33	7.62	0
October.....	56.8	91	23	3.33	1.48	4.08	0
November.....	44.3	80	14	2.81	2.23	5.85	.8
Fall.....	56.0	98	14	9.58	5.04	17.55	.8
Year.....	53.1	105	-13	44.39	33.56	53.90	25.8

AGRICULTURE

In the early agriculture of the Salem area, more attention was given to the production of crops and products that were essential to subsistence than to those raised for purposes of trade. Vegetables, corn, and grain were grown in small fields. Flax was grown to some extent. Most of the settlements were located near tidewater, and the settlers engaged in fishing and hunting to supplement the subsistence crops. As the settlements increased in number and as population increased, trade relations were established, and the acreage in corn, wheat, rye, oats, flax, buckwheat, and potatoes was enlarged.

With navigation established on Delaware River and adjoining creeks, the building of roads and railroads to the more inland sections, and the concentration of population in the near-by cities, agricultural and industrial development were rapid. The type of agriculture thus established consisted of general farming supplemented by dairying and market gardening. In many parts of the area truck growing has assumed considerable importance, and the land in many places has become too valuable to be utilized for any other purpose. Hence, many farmers are now changing from dairy farming to the production of special crops. The census data for Salem County are fairly representative of the area. They show the changes that have taken place between 1879 and 1919.

Acreage of the principal crops in 1879 and 1919

Crop	1879	1919	Crop	1879	1919
	<i>Acres</i>	<i>Acres</i>		<i>Acres</i>	<i>Acres</i>
Corn.....	30,460	23,485	Rye.....	601	677
Wheat.....	20,255	10,401	Potatoes.....	1,653	9,093
Hay (including wild hay).....	28,519	21,580	Silage crops.....		1,341
Oats.....	5,315	738	Alfalfa.....	12	771
Sweet potatoes.....	3,240	1,703	Truck crops.....	931	9,662

¹ Data for 1899 instead of 1879.

During the period between 1880 and 1920 the average farm value, including the value of farm buildings, increased from \$5,815 to \$9,930. Although the values decreased between 1900 and 1910, the number of farms at this time was greater by about 200 than in 1920. Other than this, there was little change in the number of farms and only a slight change in their size. Ninety-six acres was the average size of the farms in 1880 and 86.1 acres in 1920. In Gloucester and Cumberland Counties the increase in the number of farms was more consistent. The value of farm implements and machinery increased from 4 per cent of the farm value to 10.4 per cent, and the value of livestock increased steadily from 8.4 per cent to 17.8 per cent of the farm value.

On the basis of value, vegetables rank first with a total value of \$3,492,698; dairy products, exclusive of those used at home, have a value of \$2,016,270; cereals have a value of \$1,697,232; hay and forage of \$1,348,578; poultry and eggs of \$695,521; and fruits and nuts of \$167,046. According to the census report cereals, including corn, wheat, oats, barley, and rye, were grown in 1919 on 35,309 acres; hay and forage, not including wild or salt hay, on 30,619 acres; vegetables, including sweet potatoes, potatoes, and other vegetables, on 20,398 acres; and strawberries on 262 acres. There were also reported for

the year 31,177 bearing apple trees, 29,015 peach trees, 9,859 pear trees, 2,842 cherry trees, and 1,019 plum trees.

Corn occupies the greatest acreage of the crops in the area. Nearly every farmer produces some corn, if only a few acres. Hay is next to corn in acreage. Most of the corn and hay is utilized on the farms, although a little is sold to the exchanges and is ultimately shipped out of the area. Much of the winter cuttings of wild or salt hay from the tidal marshes is sold. It is used for packing purposes, for cores for pipe in foundries, and for many other purposes. When it is kept on the farm, it is used for bedding livestock. The summer cuttings have some value as feed for horses. Very little oats and rye is grown. These crops are generally used for cover crops and are turned under. Wheat is much more important, being third in respect to acreage. Most of the wheat is sold.

In those parts of Gloucester and Cumberland Counties within the survey, potatoes, sweet potatoes, and tomatoes are the principal truck crops. According to the 1920 census report, the total acreage of sweet potatoes in Gloucester County greatly exceeds that in Salem and Cumberland Counties combined, but the total acreage of potatoes in Salem County nearly equals that of Gloucester and Cumberland Counties combined. Peppers, eggplant, and asparagus are important vegetable crops in the area surveyed, and the acreage in string beans, Lima beans, onions, sweet corn, beets, carrots, melons, cantaloupes, rhubarb, lettuce, cabbage, cucumbers, pumpkins, squash, and okra is on the increase. Strawberries, peaches, apples, blackberries, dewberries, and grapes are the principal fruits grown. Cranberry culture is practically undeveloped.

Dairying constitutes an important feature of the agriculture of the area. Fresh whole milk is the principal product. Some of this is marketed in near-by towns, but the greater part of it is bought up by the ice-cream manufacturers and disposed of as milk or as ice cream. There are no creameries in the area, but some butter is made on the farms.

Purebred and grade Holstein cows is the principal breed used for commercial milk production, but many farmers who do not sell milk have Jersey, Guernsey, or grades of other breeds. Some interest has been developed in the raising of hogs and in the curing and marketing of pork products. Where sold, the hogs are usually handled by local dealers. Duroc-Jersey, Poland China, Hampshire, and Berkshire are the preferred breeds. The poultry industry is important in several parts of the area, especially in Cumberland County. The White Leghorn is the principal breed of chicken.

In a region of comparatively low relief such as this, the influence of surface configuration on crops is not so marked as in a region where the range in elevation is greater. The elevations are not high and the surface is not broken, so that all kinds of labor-saving machinery can be utilized in the most economical production of crops. On the other hand, there is a considerable proportion of poorly or imperfectly drained land where the production of farm crops is prohibited or at least restricted. In the well-drained uplands nearly all crops are produced, although there seems to be a tendency to plant orchards in the higher and more rolling country. Dairying predominates in the imperfectly drained areas where much of the land must be used for pasture. The poorly drained or swampy land and the tidal marshes

along the Delaware River and its tributary streams are practically uncultivated, although the higher knolls in the marshy places produce some wild hay. In times past an effort was made to develop the cranberry industry in the mucky parts of the swamps.

In this area, where there is great diversity in soil texture and soil conditions and excellent transportation facilities to the largest markets of the East, a very intensive system of agriculture, made necessary by the ever-increasing land values, has been developed. Under these conditions, as might be expected, much attention is given to the adaptation of soils to crops. The well-drained sands, coarse sands, loamy sands, and gravelly sands, as well as the deep phases of Collington sandy loam and Sassafras sandy loam, are recognized as excellent for the production of early truck crops. The sandy loams are preferred for general farming and the production of mid-season truck crops, and the loams are used more for general farming and growing potatoes. The heavy silty clay loams are used for corn, hay, and pasturage, and the well-drained gravelly soils are considered especially good for fruits.

Corn is the principal cereal grown in the Salem area. Reid Yellow Dent is the predominant variety. Salem Yellow Dent is a local name given this variety, as it has been selected and under constant production in the area for a great many years. Most corn is planted in checkrows, the hills being about 4 feet apart, and level cultivation is generally practiced. The corn is harvested and husked standing, and stalks are set up in shocks. Corn is usually fertilized lightly or not at all. When it is grown on sod land, 10 tons of manure to the acre are generally applied, and when it follows grass, from 600 to 1,000 pounds of a 3-8-6¹ fertilizer are applied. The fertilizer is either broadcast or is put in the hill after a little soil is thrown on the seed.

Wheat is the cereal next in importance. The varieties grown are Leap (Leap's Prolific) and Fulcaster, and a mixture of these varieties. Nearly all the wheat grown is sown in the fall. It is usually disposed of at the local exchanges or is sold directly to the mills.

Cover crops are very generally grown, and very little land is left bare in the winter. Rye alone, wheat alone, rye and vetch, or rye, vetch, and crimson clover together are commonly used as cover crops.

Most of the hay crop consists of timothy with either alsike clover or red clover. Some timothy and alfalfa are grown with or without red clover. In some places there seems to be a prejudice against the use of red clover, for the liming which is required for best results with it also favors the development of potato scab. In lower areas, alsike clover is preferred as it does not winterkill readily. Wild salt hay in the marshes is cut in summer if meadows are dry, otherwise in winter.

The acreage in alfalfa in this part of New Jersey, although small, is increasing. This legume is used in hay mixtures, and many farmers consider it better than either red or alsike clover. Cumberland County has a greater acreage in alfalfa than any other county in the State. In parts of Salem County considerable trouble is experienced in maintaining a stand of alfalfa. Three years in many places

¹Percentages, respectively, of ammonia, phosphoric acid, and potash.

seems to be the extreme life of the plants. Winterkilling is responsible for most failures. Alfalfa grows best on the high, well-drained uplands.

In addition to the hay crops mentioned, some acreage is devoted to cowpeas, soybeans, and Sudan grass. Some sweet clover is grown, usually for soil improvement.

Two crops of potatoes are generally grown. The varieties for the early crop are Irish Cobbler, Green Mountain, Rural New Yorker, Mills Pride, Burbank, True Julienne, and Early Rose, with Irish Cobbler predominating. The first crop may be classed as early and mid season and the other as late season. The principal varieties used for the late crop are Red Skin, Superbas, Giants, Pink Eyes, and Norcross. Of these the Red Skin (Dakota) predominates. The crop is generally planted with two-horse planters, although some of the planting is done by hand. Level culture is used in the early part of the season, but the fields are ultimately ridged. This crop is generally fertilized in the row, the applications ranging from 400 to 1,200 pounds to the acre of a 2-8-6 or 4-8-8 mixture. Most of the crop is harvested with potato diggers and is picked and sacked by hand.

Sweet potatoes are usually bedded in the early part of April, and artificial heat is sometimes applied. The last week in May or early in June the slips are set out about 3 feet apart and spaced about 20 inches apart in the row. On large acreages planters are used. Some of these water and plant in the same operation. Small acreages are generally planted by hand. Commercial fertilizers, 3-8-3 or 4-8-4 mixtures, are usually applied for this crop. Formerly considerable manure was used in addition, but this practice has been abandoned on account of spreading disease. The common varieties of sweet potatoes grown are Yellow Jersey and Red Jersey. Special plows are used to harvest the crop. The potatoes are graded, shipped in hampers or barrels, or stored for winter use or sale.

Tomato seed is usually sown in open beds in early April, and the plants are set out about May 10 for the early crop and about June 10 for the late crop. Plants are generally checkrowed about 4 feet apart to facilitate cultivation. Some of the planting is done with planters, but much is done by hand. The plants are generally fertilized with a mixture which averages about 4-8-4, in applications varying from 400 to 800 pounds to the acre. Available manure is also used in applications ranging from 6 to 8 tons to the acre. Various mixtures of fish guano or poultry manure are sometimes used with stable manure. The fertilizer is either placed in the hills or is broadcast. When the fruit is setting, some growers supplement the fertilizer mixtures with 100 pounds of nitrate of soda. The principal varieties of tomatoes grown for the early market are Earliana, Chalks Early Jewel, Bonnie Best, and Livingston's Globe. The Marglobe, a new variety, is rapidly gaining favor. Greater Baltimore, Cumberland Red (local variety), Matchless, Stone, and Ponderosa are grown for the late market or for canning. The plants are cultivated at frequent intervals, shallow cultivation being used first and deeper cultivation later in the season. The bulk of the crop is of late varieties and is sold to local canners or shipped to Camden or Baltimore.

Peppers for the early crop are removed from the hotbeds about the middle of May. The plants are usually spaced about 2 feet apart, in rows 3 feet apart. The fertilization practice is about the same as

for tomatoes. Peppers are more easily harvested than tomatoes, as they do not all ripen at the same time, as is often the case with tomatoes. Harvesting begins about July 1 and continues until frost; the crop is shipped in hampers or barrels. The principal varieties of sweet peppers are Ruby King, Chinese Giant, and Ruby Giant, and Long Hot, Chinese Hot, Cherry, and Finger are the principal varieties of hot peppers.

Sweet corn is becoming an important crop on account of the demand from near-by resorts. The principal varieties grown are Crosby's Early, Country Gentleman, Stowell's Evergreen, Howling Mob, and Golden Bantam.

Eggplant is an important truck crop. This is generally transplanted by hand from the hotbeds. It is cultivated and fertilized much as tomatoes are and is harvested and shipped in hampers. The principal variety is Blue Egyptian.

The acreage in asparagus is steadily increasing. The plants are generally started as seedlings and are transplanted the second year. Most market gardeners plant asparagus in rows about 3 feet apart and space the plants from 2 to 3 feet apart in the rows. The crop is cultivated, fertilized, and sprayed regularly, but the greater part of it is not harvested until the third year. By that time the roots have had a better chance to develop. Most of the asparagus is shipped in crates. It is a very profitable crop.

The production of onions is increasing in importance, particularly in the southern part of the area. Most of the crop is grown from sets. The onions are usually marketed before the first of July. Most of the sets are obtained from Ohio, Connecticut, and New York, but some farmers grow their own. Two applications of fertilizer, about 400 pounds to the acre in the first and 300 pounds in the second, are generally broadcast over the soil. Yields range from 300 to 400 bushels to the acre. The sets are usually planted from 6 to 9 inches apart in rows about 2 feet apart. The planting is done in the latter part of March in soil that has been plowed to a depth of 9 inches. The crop is weeded once by hand and is cultivated with one-horse, shallow-tooth cultivators. Most of the onions are grown on the lighter Sassafras soils in the southern part of the area, particularly in the vicinity of Cedarville. Southport White Globe and White Portugal are the principal winter varieties, and Yellow Globe, Danvers, Southport Yellow Globe, Yellow Dutch, and Ebenezer or "Japanese" are the principal summer yellow varieties. Onions have been produced continuously on the same fields for a period of six or eight years. Cover crops are usually sown after the onions are removed.

Bush and pole beans, as well as early market and canning peas, are also important crops. On most farms the principal bean varieties are French and Fordhook; among the peas the canning variety chiefly produced is the Alaska, and the early market varieties are Thomas Laxton, Gradus, and Telephone.

Peaches are the most important fruit crop in Gloucester and Cumberland Counties but, according to the census statistics, there is a difference of only 2,000 trees between the number of peach trees and the number of apple trees in Salem County. Commercial peach orchards are large and well cared for. Before the trees begin to bear, the land is usually utilized for truck crops. The orchards are

thoroughly cultivated and are heavily fertilized. Some orchardists use bone meal and manure in the proportion of about 600 pounds of bone meal to 6 tons of manure. Others use superphosphate (acid phosphate) and poultry manure, muriate of potash, and nitrate of soda in varying quantities. The nitrate of soda is used on the young orchards in applications ranging from 150 to 400 pounds to the acre. The trees are usually sprayed four or five times a year with commercial lime-sulphur and once or twice with arsenate of lead. Most of the peach crop is shipped to New York. During the season, special trains are run to handle the product. The principal varieties grown are Elberta, Carman, Champion, Iron Mountain, Greensboro, Hiley, Krummel, Ray, and Early Crawford. The largest and best peach orchards are on the higher uplands where they seem to be affected less by late spring frosts.

Apple orchards are common throughout the area. Many of these, among them a few large commercial orchards, are planted on the lower and heavier soils, but there seems to be a tendency to locate new orchards on the high, lighter, and well-drained soils. Orchards that receive good care have proved very profitable. The fruit is shipped direct to Philadelphia and New York, is stored for winter markets, or is placed on the market as demand arises. The principal varieties of apples grown are Wealthy, Early Red, Grimes Golden, Winesap, Stayman Winesap, Rome Beauty, and Yellow Transparent.

Among the pears Kieffer is the predominant variety. It is a poor eating pear and is sold largely to canners. Though most of the orchards have been damaged by blight, some that have been properly fertilized, cultivated, pruned, and sprayed are in good condition and have proved profitable.

A number of sour-cherry trees have been planted throughout the area, and it is probable that this fruit could be profitably grown. Grapes are becoming important, and a large quantity of the Concord and Ives varieties are grown, particularly in the southeastern part of the area. Blackberries and dewberries are grown extensively, and some raspberries are produced.

Strawberries are produced extensively. Most of the patches cover from 1 to 3 acres, although there are many as large as 15 acres. The practice among the best farmers is to put in 1 or 2 acres of strawberries and to plow under a similar acreage. The beds are rarely maintained more than 3 years. The plants are usually top-dressed in the fall with 600 or 800 pounds of bone meal and in the spring with 100 or 150 pounds of nitrate of soda. Some growers use manure in the fall and nitrate of soda in the spring. The strawberry rows are spaced from $3\frac{1}{2}$ to 4 feet apart, and the plants are set at about 18-inch intervals in the row. The berries are sold on the local market or are shipped to Philadelphia and New York. The principal varieties are Campbells Early, Campbells Tardy, Premier, and Ruby King.

Cantaloupes and watermelons are becoming important crops. The principal varieties of the former are Fordhook and Jenny Lind and of the latter are Kleckley Sweets and Tom Watson.

No definite rotation of crops is followed. Where general farming is practiced, corn or potatoes usually follow sod, and these are followed by timothy and clover. Some farmers produce two or three crops of corn in succession; others specialize in the production of potatoes

and resort to cover crops to keep the land in good condition. Flat land, on which farming is restricted by poor drainage, is used in large measure as permanent pasture. Where conditions are more favorable cover crops of rye, vetch, or crimson clover are sown in the corn at the time of the last cultivation. The cover crop is turned under the following summer and late potatoes are planted. These are followed by a cover crop of rye, and the next spring the land is used for an early truck crop. Tomatoes are sometimes substituted for, or follow, potatoes in the rotation, but tomatoes are never followed by potatoes.

Farmers who specialize in sweet potatoes grow this crop on the same land as long as five successive years. Then the land is heavily manured and is utilized for truck crops for several years, after which it is returned to sweet potatoes. Early peas are usually followed by late potatoes on the truck-crop soils.

Land with overhead irrigation is steadily increasing in area. Under favorable conditions irrigation is considered a profitable investment.

Between 800 and 900 acres of irrigated land are in Cumberland County. Nearly all the irrigated land is Sassafras loamy sand, Sassafras sandy loam, deep phase, Sassafras gravelly sandy loam, and Sassafras sandy loam. The water is obtained from lakes, ponds, wells, or streams. Pumps operated by electric power or gasoline engines are used. The water is pumped either directly to the fields or to standpipes or water towers. The cost of installation varies with the acreage and the type of pumping unit. One operator placed his cost at \$3,300 for 11 acres, which was the maximum distribution power of his pump. This outfit sprayed about 4 acres at a time and the pumping expense was about \$10 a day.

The crops grown on irrigated areas are beets, lettuce, carrots, onions, spinach, and celery.² Celery follows onions and beets. Lettuce follows carrots and spinach in the fall. Lettuce, one of the principal crops, produces an early spring and a fall crop. The yields range from 1,000 to 1,500 crates (24 heads to the crate) to the acre. Early lettuce may be followed by onions or string beans. Some strawberries are grown on these plots, as well as early peas and considerable spinach. No definite rotation is followed. From 25 to 35 tons to the acre of stable manure are used with each ton of fertilizer for each crop. In addition, heavy applications of nitrate of soda are made.

According to the census report of 1920, the amount of money spent in 1919 for fertilizer by Cumberland, Gloucester, and Salem Counties, respectively, is \$1,074,081, \$1,322,259, and \$1,275,571. There is considerable difference in the analysis of the mixtures used and in the quantities applied. Commercial mixtures predominate, although considerable home-mixed fertilizer is used. Among the commercial mixtures the common ones for potatoes are 4-8-5, 4-8-6, 4-8-8, 5-8-6, and 5-8-7 mixtures, applied at the rate of about 1 ton to the acre.

Scab has been so prevalent in potatoes that considerable inoculated sulphur has been used to control the disease. The fertilizer mixtures used for potatoes are also used at times for corn. The mixtures for wheat and tomatoes analyze 3-8-3 and 2-8-5, and the application ranges from 200 to 1,600 pounds to the acre.

² HUBER, H. F., GROSS, E. R., and LUCAS, D. B. SPRINKLING IRRIGATION ON VEGETABLE FARMS IN NEW JERSEY. N. J. Agr. Expt. Sta., Bul. 453, Nov., 1927.

All available stable manure is used, and much is shipped in from near-by cities. The home-mixed fertilizers consist usually of poultry manure supplemented by 16 per cent superphosphate (acid phosphate). The price of stable manure ranges from \$3 to \$6 a ton, and poultry manure costs 50 cents a bushel. Raw and steamed bone are also used in addition to high-grade potash and nitrate of soda.

The farms of the Salem area are generally well equipped, but more space could profitably be used for storage of crops. All kinds of improved tools and farm machinery are utilized, but on the truck farms considerable hand labor is required. The cultivation of the land is generally thorough and the methods used are efficient. Most of the work on the small farms is done by the farmer and his family, but in many localities there is a demand for labor even on the smaller farms. The compensation for labor ranges from \$60 to \$80 a month. In some of the truck-farming districts in the northern part of the area much of the harvesting and packing of truck crops is done on a piece basis, under contract, by Italians from the near-by cities.

According to the census reports of 1920, the percentage of farms operated by owners in Cumberland County was 80.2 per cent, in Gloucester County was 77.3 per cent, and in Salem County was 62.9 per cent. The percentage operated by tenants in Cumberland County was 17.7 per cent, in Gloucester County was 21.3 per cent, and in Salem County was 35.5 per cent. Managers operated 2.1 per cent of the farms in Cumberland County, 1.4 per cent of those in Gloucester County, and 1.6 per cent of those in Salem County. The rental is usually a share of the crops grown on the rented land. Share renters usually pay half the expense and retain half the crops. Where they supply labor only they receive one-third of the crops.

Land values have a wide range. Inconveniently situated uncleared land from which the merchantable timber has been removed ranges in value from \$5 to \$20 an acre. Similar lands, better situated, are valued much higher. Cleared farm lands range in value from \$50 to \$175 an acre, depending on location, improvements, and other factors. Orchard and irrigated property has a very high value.

SOILS

The soils of the Salem area are extremely variable in their distinguishing features, especially in texture, color, and drainage. The range is from coarse, open sands, through which rain water passes downward at a rapid rate, to soils with impervious clay subsoils having very poor natural drainage. Along the streams extensive strips of swamp land are saturated at all times, and along Delaware Bay and the lower courses of streams entering it extensive flats are daily inundated by tidewater.

The soils of the area have been differentiated on the basis of the characteristics of the soil and of the parent material from which it has developed. The soil characteristics include the color of the surface soil, the succession of the soil horizons and the general characteristics of each, and the depth to which the soil-forming processes have practically obliterated the features of the parent material.

The features of the parent material, or the basis on which the soils are differentiated, include mainly the mineralogical differences of the various materials. The most striking mineralogical differences of this character are differences resulting from the presence or absence of

glauconite or greensand. For example, the Collington soils have developed from materials containing considerable greensand and the Sassafras soils from materials containing no greensand.

Other differences in the soil result from differences in drainage conditions. Some soils have not developed normally because of subjection to excessive moisture. The normal soils of the area are the members of the Sassafras series and most of those of the Collington series.

The soils of this region have been further modified by the effect of the moisture on the decaying remains of plant life. For example, in depressions where the drainage is poor throughout the year, the Portsmouth soils occur. These are dark gray or black and are rich in organic matter. On the other hand, in some flat areas where the soil materials are subjected to intermittent wet and dry conditions, light-colored soils such as the Elkton prevail. On the better-drained highlands where the soils have formed under conditions of good drainage, most of the soils have brown or light-brown surface soils. Under certain conditions of good drainage and thorough oxidation reddish colors have developed in the material, especially in the subsoil. In some places the red color seems to be the result of an exceptionally high content of iron salts, whereas in other places it appears to be the normal color under good drainage.

In the undulating, flat well-drained upland areas, the prevailing features of the soil as they appear from the surface downward, especially in the sandy loams and loams, are as follows: (1) Light-brown or brown, friable and permeable material 10 or 12 inches thick; (2) yellow or reddish-yellow material, usually friable, in which there is a concentration of clay, apparently caused by infiltration from the layer above; (3) material, occurring usually below a depth ranging from 20 to 40 inches, which contains considerably less clay than the second layer and has a markedly coarser texture and a more decidedly yellowish color.

In large areas in the uplands the material is loose sand several feet thick. The surface of most of these areas is undulating, rolling, or hilly, and the material seems to correspond, texturally at least, very closely to that of the original deposits, except for the discoloration of the surface soil by oxidation and incorporation of vegetable matter and of the subsoil by oxidation. On some of the flat areas, the flat surface and inadequate drainage outlets unquestionably result in a comparatively mild oxidation and in many places in a lighter color in both the surface soil and subsoil. In these areas light-gray and bluish-gray mottles are common at a depth ranging from 18 to 30 inches, and in some places there is some compaction at a depth of about 30 inches, even where the texture of the material is lighter than in the uncompacted layer above. This condition has not been clearly explained.

All of the well-drained soils of the area were originally covered with forest. They contain only moderate quantities of organic matter. The highest content of organic matter is found in the more poorly drained soils and in wet areas, such as those occupied by the Portsmouth soils. The organic matter in such areas is obviously very different from that in the well-drained soils. In the Portsmouth soils, it might be described as more or less inert or incompletely decomposed matter.

All of the soils of the area are highly siliceous, and most of them are highly quartzose. There is not much sand, of course, in the oozy material of the tidal marsh but sand is abundant at a comparatively slight depth beneath the swampiest strips along the major streams. Another characteristic common to the soils is that they are prevalently acid in reaction, few being above 6 in their pH values. With the exception of rather small areas of heavy soils, such as Keyport silty clay loam and Alloway silty clay loam, the soils are all friable and easily worked. Their position renders possible the use of any type of agricultural machinery. Much more land lacks arability by reason of poor drainage than by reason of unfavorable surface features.

The eastern part of the area consists largely of undulating and rolling highland having good or excessive drainage. A considerable strip along the western part, even above the areas of tidal marsh, is comparatively low, flat country where considerable poorly drained land requires ditching or tiling before it can be successfully used for crops.

The well-drained soils are included in the Collington, Sassafras, and Colts Neck series; soils having intermediate drainage have been mapped in the Woodstown, Elkton, Alloway, Keansburg, Shrewsbury, and Keyport series; and exceedingly wet or permanently saturated soils are classed in the Portsmouth and Freneau series and as swamp, tidal marsh, and meadow.

The Sassafras soils have brown surface soils and are buff or reddish yellow in the layer beneath. Below a depth ranging from about 20 to 40 inches the material is considerably coarser than in the upper part of the subsoil, and the color is a more decided yellow. These soils are friable, permeable, well drained, and well oxidized.

The Collington soils resemble the Sassafras soils, but the greenish color of glauconitic sand is everywhere present in the surface soil and subsoil. It stands out conspicuously, so that in some places the soil is decidedly green. The lower part of the subsoil of the Collington soils is not coarser in texture than the upper part of the subsoil, as is the case in the Sassafras soils. In fact, in some places rather stiff green-sand clay occurs at a depth of 30 or 40 inches. The entire subsoil is characteristically friable and permeable, and the drainage is everywhere well established.

The soils of the Colts Neck series are characterized by a rust-brown, reddish-brown, or brownish-red color, a high content of iron, thorough drainage, and a high state of oxidation. The zonation of the material is not distinct. In general, the soils are friable and permeable.

The soils of the Woodstown series are much like the Sassafras soils to a depth of about 2 feet. Below this they are mottled yellow and gray. In other words, the Woodstown soils consist of Sassafras material in the upper part and material resembling that found in the subsoils of the Elkton soils in the lower part.

The soils of the Elkton series are light gray when dry and are mottled with yellow or rust brown in many places. The subsoils, which seldom become dry, are mottled light gray, bluish gray, and pale yellow. They range in texture from sandy loam to clay. These soils are subject to intermittent wet and dry conditions.

The Alloway soils have, as a rule, brown or dark-brown surface soils and bluish, yellowish, and reddish subsoils of plastic clay or sandy clay.

The Keansburg soils have dark-gray or black surface soils much like those of the Portsmouth soils, although the organic matter seems

to be better decomposed. There is commonly much more clay in the subsoil. The surface soil is black, as a rule, and the subsoil is mottled blue, bluish gray, reddish brown, yellowish red, yellow, and green. These soils contain much glauconitic material, especially in the subsoil, whereas the Portsmouth soils contain none.

The Shrewsbury soils have the same relation to the Elkton that the Keansburg have to the Portsmouth. Although somewhat deeper brown, the surface layer is much the same as that of the Elkton soils when dry, but the subsoil contains considerable greenish glauconitic material and is highly mottled with many colors, chiefly light gray, bluish gray, pale yellow, reddish yellow, and green or various tints of green.

The Keyport soils also resemble the Sassafras in the surface soil. Their subsoils are commonly not so reddish in color and grade downward to plastic blue and yellow clay.

The Portsmouth soils have dark-gray or black surface soils, rich in organic matter which has undergone only partial decomposition. The subsoils are light gray or bluish gray, commonly mottled with yellow, reddish yellow, or rust brown. They are continuously saturated for long periods and give an acid reaction.

The Freneau soils consist of alluvial material which, within small areas, varies widely in both texture and color. The material consists of considerable wash from soils derived from the greensand beds, mixed with material washed from other soils. The color in the upper part is prevailing dark brown or almost black, mottled with rust brown and dark blue and in the lower part is bluish, greenish, rust brown, yellow, and red. There is wide variation in texture, both vertically and horizontally.

Areas mapped as swamp, tidal marsh, and meadow consist of miscellaneous materials and will be described in the following chapters. The following table gives the acreage and proportionate extent of the soils of the Salem area, in the order of their agricultural importance. Their distribution is shown on the soil map which accompanies this report.

Acreage and proportionate extent of soils mapped in the Salem area, New Jersey

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Sassafras loam	39,232	11.6	Keyport silt loam	3,008	0.9
Sassafras silt loam	11,136	3.3	Keyport silty clay loam	1,792	.5
Sassafras loamy sand	22,848	9.0	Elkton sandy loam	3,008	.9
Flat phase	7,424		Elkton loam	704	.2
Sassafras sandy loam	33,280	13.0	Elkton silt loam	3,712	1.1
Deep phase	6,976		Alloway sandy loam	1,024	.3
Depressional phase	3,264	2.3	Alloway loam	1,408	.4
Sassafras fine sandy loam	7,616		Alloway silty clay loam	5,312	1.6
Sassafras gravelly sandy loam	16,896	5.0	Shrewsbury sandy loam	576	.2
Sassafras sand	13,632	5.4	Shrewsbury loam	640	.2
Flat phase	4,800		Colts Neck loamy sand	832	.2
Sassafras coarse sand	1,344	.4	Keansburg sandy loam	320	.1
Sassafras loamy coarse sand	4,544	1.3	Woodstown sandy loam	1,536	.5
Collington sandy loam	6,208	4.5	Woodstown loam	8,896	2.6
Low greensand content phase	5,632		Portsmouth loamy sand	832	.2
Deep phase	3,456	.3	Portsmouth sandy loam	3,904	1.2
Collington fine sandy loam	1,152		Freneau loam	3,520	1.0
Collington loamy sand	1,856	1.9	Reclaimed tidal marsh	23,360	6.9
Low greensand content phase	4,480		Tidal marsh	37,696	11.2
Collington loam	2,048	1.1	Meadow	7,936	2.4
Low greensand content phase	1,728		Swamp	14,144	4.2
Keyport sandy loam	5,120	2.2	Coastal beach	192	.1
Deep phase	2,496				
Keyport loam	5,760	1.8	Total	337,280	

SASSAFRAS LOAM

The surface soil of Sassafras loam consists of brown or light-brown loam 10 or 12 inches thick. This grades to yellowish-brown or reddish-yellow friable fine sandy clay, clay loam, or silty clay which is variable in thickness and is underlain, within a depth of 3 feet, by lighter-textured material which is separated from a gravel bed by a transitional layer of sand or loamy sand of more reddish color. The surface soil in most areas has a well-developed crumblike structure and only in places is it compacted. The color becomes more gray during protracted dry spells.

Included with mapped areas of this soil are patches of Sassafras silt loam, Sassafras fine sandy loam, Sassafras gravelly sandy loam, more rarely Sassafras sandy loam, and poorly drained Sassafras loam.

Numerous areas of gravelly Sassafras loam are included with this soil and are shown on the soil map by gravel symbols. These areas differ from typical in that the heavy layer in the subsoil is generally thinner and in places is lacking and in that there are conspicuous quantities of small rounded quartz gravel in the surface soil and the upper part of the subsoil. These areas represent Sassafras loam modified by the immediately underlying gravel beds. In general, the subsoils are characteristically reddish yellow or reddish brown. Typical areas of this soil are in the vicinity of Cohansey and Finley Station and in many other parts of the area. The presence of gravel within the soil and on the surface does not interfere with cultivation or restrict the use of this soil for farming.

Included also with Sassafras loam are areas of poorly drained Sassafras loam which differ from typical in that the lower part of the heavy subsoil and the lighter material underneath are characterized by slight mottling of yellow and gray. In included areas of poorly drained Sassafras silt loam, the surface soil is slightly heavier. Such areas occupy depressions near streams or their tributaries. In a wet year, crops frequently suffer, but during a dry year excellent crops of corn, hay, and grain are grown. Such areas afford excellent pasturage, and the pasture is said to be almost permanent. The use of tile would do much to improve the subsurface drainage.

Another variation of Sassafras loam, and the most important as regards distribution, is represented by the flat areas. In such areas the lower part of the subsoil is nearly always moist and is not infrequently saturated with water. In many places the material is mottled with yellow and gray. These areas are contiguous to tidewater or tidal marsh, especially along Delaware River and its tributaries. This land is utilized for the production of general farm crops. Crops are usually planted later in spring than on the typical soil, and they mature later. Artificial drainage in many places is imperative if the best results are to be obtained.

Sassafras loam is one of the important soils of the area. It is extensively distributed throughout the coastal, western, eastern, and southern parts of the area. It occupies gently rolling or undulating country and is well drained. In some patches on stream slopes surface drainage is rather excessive, and the surface soil has been removed by wash or erosion, exposing the underlying heavy subsoil. Locally the underlying gravel bed comes close to the surface, under-drainage is excessive, and crops suffer during dry spells. The surface

features in general are such as to conserve soil moisture, and this soil is one of the last to show the effects of the dry weather. All kinds of farm machinery can be utilized to advantage, and crops can be economically produced.

Considerable dairy farming is done on this land, but there is little or no truck farming. The principal crops are corn, wheat, potatoes, and hay, supplemented by the products of home gardens and orchards. On many farms potatoes are a specialized crop. Generally two crops are grown each year, the first crop being Irish Cobbler and the second being Redskin, Superba, Giant, or Norcross. The yields range from 155 to 280 bushels to the acre. Corn yields from 60 to 80 bushels, wheat from 25 to 35 bushels, and hay from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons to the acre. The mixture for hay on this soil is generally timothy, alfalfa, and red clover.

Practically all of this soil is under cultivation. It is considered one of the strongest and most dependable soils in the area for general farm crops. It is managed with considerable efficiency and the methods used are commendable.

This land is currently valued at figures ranging from \$100 to \$200 an acre, depending on location and improvements.

SASSAFRAS SILT LOAM

The surface layer of Sassafras silt loam consists of brown or light-brown silt loam from 4 to 8 inches thick. This grades to yellowish-brown or brownish-yellow silt loam which, within a depth of 16 inches, grades to yellow or slightly reddish yellow, friable silty clay loam or light silty clay. Beneath this, at a depth varying from 24 to 36 inches, is light material of variable texture. Much of the surface soil has a well-developed crumblike structure, although there are places where it is very compact. When moist or wet it is brown in color, but it has a decided grayish cast during prolonged dry spells.

Locally the color of the heavy subsoil layer may be more nearly red or reddish brown, and in places the texture of the lower part of this layer changes to sandy clay loam or sandy clay. There is considerable variation in texture and structure near a depth of 3 feet, depending on the proximity of the underlying gravel bed. In most places the gravel bed occurs at a greater depth than in the associated Sassafras loam.

Mapped areas of this soil include patches of Sassafras loam, Sassafras fine sandy loam, Sassafras gravelly loam, less commonly Sassafras sandy loam, and in some small depressions, imperfectly drained Sassafras silt loam, Woodstown silt loam, or some member of the Elkton series. Some very small areas of gravelly Sassafras silt loam are included. They are indicated on the accompanying map by gravel symbols. In these areas the underlying gravel bed comes close to the surface. These areas lie southwest of Harmony and near Shiloh. Some included flat areas resemble the flat areas of Sassafras loam, except that the surface soil and the upper part of the subsoil are heavier in texture. One of these areas occurs in Becons Neck. Another is $1\frac{1}{2}$ miles northwest of Hancocks Bridge.

Sassafras silt loam is not so widely distributed as the associated Sassafras loam. Typical areas occur in the vicinity of Daretown and Shirley and on the uplands in the vicinity of Deerfield.

Most of the Sassafras silt loam occurs in rather large areas in undulating or slightly rolling country, but some areas are almost flat. Drainage is generally well established. This soil withstands more protracted dry spells than Sassafras loam, and crops rarely suffer from drought. The surface relief is such that all kinds of labor-saving machinery can be utilized to advantage, and crops can be economically produced. Practically all of this soil is under cultivation to such general farm crops as corn, wheat, potatoes, and hay, supplemented by the products of home gardens and orchards.

The yields of corn range from 60 to 100 bushels, of wheat from 25 to 40 bushels, and of hay from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons to the acre. Potatoes yield from 125 to 220 bushels to the acre.

This soil is well managed. Current prices range from \$100 to \$200 an acre.

SASSAFRAS LOAMY SAND

The surface soil of Sassafras loamy sand consists of brown loamy sand from 5 to 10 inches thick. This is underlain by orange-colored loamy sand which commonly grades in color to reddish yellow within a depth of 3 feet.

There are some variations in color and texture. In these the upper part of the subsoil is yellow loamy sand or sandy loam, and the orange or reddish color is present near a depth of 3 feet. In places in the lower part of the subsoil loamy coarse sand and even gravel is present. A few small areas of Sassafras loamy fine sand are southeast of Mullica Hill, south of Harmersville, and northeast of Bridgeport. This soil has about the same productive value and is managed in about the same way as Sassafras loamy sand.

In some included imperfectly drained areas the lower part of the subsoil is slightly mottled with gray and yellow. Proportionately more of these areas are used for corn, hay, and pasture than of the typical soil, for in dry years this soil holds up better and the yields are much heavier. Yields of truck crops are also heavier than on the typical soil, but crops do not mature so early. Such areas occur northwest of Greenwich and near Canton.

In places well-rounded quartz gravel is scattered over the surface of Sassafras loamy sand. Such areas are shown on the accompanying map by gravel symbols. Gravelly areas are northwest and north of Swedesboro, northwest of Harrisonville, and north of Northville.

Sassafras loamy sand occurs rather extensively in all parts of the area. It occupies undulating or gently rolling country. The surface relief is such that all kinds of labor-saving machinery can be operated, and crops can be economically produced. Drainage is good. The loaminess of the surface soil and subsoil allows the retention of more moisture than is held by the sand of this series. Hence, crops withstand the dry spells better. Farmers consider this a very desirable soil for overhead irrigation. Where overhead irrigation is practiced there seems to be, in places, a concentration of finer material at the immediate surface. This is the reverse of the condition in most eastern soils, in which the concentration is in the subsoil.

Probably 75 per cent of this soil is utilized for farming. The rest of it supports a growth of scrub oak and pine and an undergrowth of laurel, huckleberry, sassafras, and ferns.

Where cultivated, *Sassafras* loamy sand is used for early truck crops and for corn, potatoes, sweet potatoes, hay and forage crops, and some small fruits such as strawberries, dewberries, blackberries, raspberries, and Logan blackberries. The yields of truck crops are heavier than on the sand soils of the *Sassafras* series, but the sand produces the earliest crops. The principal truck crops are peas, beans, tomatoes, asparagus, eggplant, peppers, watermelons, and cantaloupes. Two crops of potatoes are sometimes grown in a year on this land, and each crop yields from 125 to 250 baskets to the acre. Corn yields from 20 to 50 bushels and hay about 1 ton to the acre. Tomatoes yield from 400 to 600 baskets and sweet potatoes from 250 to 300 baskets to the acre. The baskets contain five-eighths of a bushel.

Most of the lettuce, spinach, celery, and onions are produced with overhead irrigation. There seems to be no definite rotation, but those crops are grown which seem most profitable. Fertilization is very heavy.

Sassafras loamy sand ranges in value from \$75 to \$150 an acre, depending on location and improvements.

An adequate supply of organic matter is essential to this soil if the present yields are to be maintained or increased.

Sassafras loamy sand, flat phase.—The surface soil of the flat phase of *Sassafras* loamy sand consists of brown or grayish-brown loamy sand from 5 to 10 inches thick. Below this is yellow or reddish-yellow sand or loamy sand which may become mottled with yellow and reddish yellow within a depth of 3 feet. In some patches loamy coarse sand and *Sassafras* sand are included, and in the lower part of the subsoil coarse sand or loamy sand and in places well-rounded quartz gravel are present.

Typical areas of *Sassafras* loamy sand, flat phase, occur at Pedricktown, and in part of Paulsboro. Most areas are flat or slightly undulating and are at a level near that of the water table.

This soil is slightly more productive than *Sassafras* loamy sand for corn and hay, but the truck crops grown on it are not ready for market so early.

SASSAFRAS SANDY LOAM

The surface soil of *Sassafras* sandy loam is light-brown or brown sandy loam or loamy sand from 6 to 12 inches thick. Below this, the material is orange-yellow or reddish-yellow sandy loam which, within a depth of 20 inches, grades to yellowish-red, reddish-yellow, or red, friable sandy clay which generally becomes lighter in texture at a depth of about 3 feet.

Color and texture variations of local importance occur throughout this soil. The surface soil may be either grayish or very dark, and in places the color changes as boundaries of contiguous soils are approached. This transitional zone may have either color or a combination of both. In many places the surface layer, to a depth varying from 6 to 12 inches, is underlain directly by the sandy clay subsoil, and in other places the sandy clay subsoil is only a few inches thick and may be underlain by sand, coarse sand, loamy sand, or gravel. A few of these variations and, locally, all of them occur in a small field.

Mapped areas of this soil also include patches of *Sassafras* loam, *Sassafras* fine sandy loam, and *Sassafras* coarse sandy loam. Well-rounded quartz gravel is scattered over the surface but not so

abundantly as in Sassafras gravelly sandy loam. The gravel is conspicuous in places, particularly on the areas of Sassafras sandy loam 2 miles west of Swedesboro and 2 miles southeast of Pedricktown. Flat areas of this soil occur 1 mile southwest of Cedarville and 1 mile northeast of Hancocks Bridge, and imperfectly drained areas are 2 miles northwest of Harmony and three-quarters mile southwest of Cedarville.

Areas of Sassafras sandy loam are scattered over all parts of the area surveyed. Typical areas are north and east of Swedesboro, 2 miles southeast of Pedricktown, in the western part of Alloway, in part of Quinton and in nearly all of Bridgeton and Clarksboro.

Sassafras sandy loam occupies areas ranging from a few feet above sea level to the highest uplands. The relief ranges from slightly undulating to rolling, but the surface is generally favorable for the production of crops. Drainage is well established and in some patches on the steeper slopes is excessive. In a few places the underlying sandy clay is exposed as a result of erosion. Probably about 80 per cent of this soil is under cultivation. The rest of it supports a mixed growth of black, white, red, and post oaks, chestnut, pine, maple, dogwood, and hickory, and an undergrowth of sassafras, laurel, huckleberry, and greenbrier.

This soil is cultivated to such general farm crops as corn, wheat, potatoes, and hay supplemented by mid-season and late truck crops and fruit. Some acreage is devoted to such crops as rye and oats, and soybeans and cowpeas are used as cover crops or as green-manure crops. Alfalfa is grown to some extent. Some of the fields are allowed to remain in this crop for as long as seven or eight years, but most of them are plowed up about every three years.

The yields of corn range from 40 to 60 bushels, although 133 bushels to the acre have been reported. Wheat yields from 20 to 30 bushels, potatoes from 175 to 300 baskets, and hay (timothy and clover) from 1 to 1½ tons to the acre. Tomatoes for canning purposes yield from 5 to 7 tons to the acre. Good yields of sweet corn, cabbage, onions, peas, beans, eggplant, and peppers are obtained from this soil, but the truck crops do not mature so early as on the lighter soils of the Sassafras and Collington series.

Apples, peaches, and pears are successfully grown on some of this soil, particularly on the higher lands, under heavy applications of barnyard manure and commercial fertilizer. The yields are fairly consistent. This is considered one of the most productive soils in the area for general farm crops. It is easy to work and holds up well during protracted dry spells. The tendency in farming seems to be toward crop specialization, and rotations are not very consistent. Those crops which give promise of being most profitable appeal most to the farmers.

The uncleared areas of this soil range in value from \$30 to \$50 an acre and the cleared lands range from \$75 to \$175 an acre, depending on location and improvements.

The prevailing use of large quantities of commercial fertilizers does not lessen the need for a good supply of organic matter in this soil.

Sassafras sandy loam, depressional phase.—The soil of the depressional phase of Sassafras sandy loam differs from the typical soil in that the friable sandy part of the subsoil is slightly mottled with yellow and gray and in many places rests on less compact, lighter materials.

This soil is rather inextensive in this area. Typical areas occur southeast of Penns Grove, west of Alloway, near Deerfield, and southwest of Finley Station. Areas occupy depressions throughout the uplands, usually at the heads of draws and swales. Surface drainage is fair, but the underdrainage is not so good as in the typical soil.

Most of this soil is used for pasture land or for the production of general farm crops. In dry years heavier yields are obtained than on the typical soil, but crops are later in starting and slower in maturing.

Sassafras sandy loam, deep phase.—In the deep phase of Sassafras sandy loam, the surface soil is slightly deeper than in the typical soil. In places small rounded quartz gravel are scattered over the surface and throughout the soil. Some patches of Sassafras coarse sandy loam, deep phase, are included in mapped areas of this soil. Some included flat areas of Sassafras sandy loam, deep phase, are shown on the accompanying soil map with cross lines. These latter areas occur within or close to tidal marsh and water generally stands on the surface. In dry seasons they are more productive of general farm crops than is the typical soil.

Sassafras sandy loam, deep phase, is scattered over all parts of the area. Typical areas are northeast of Clarksboro, 1 mile north of Paulsboro, near Shiloh, and in Jericho.

Sassafras sandy loam, deep phase, occurs in undulating or rolling areas. It is well drained. Probably 85 per cent of it is cleared and used for farming purposes. The rest supports a mixed growth of various oaks, pine, and some hickory. Most of the trees are small and have little value other than for fuel. Where cultivated, this soil is used for the same crops as the typical soil. The yields are not quite so heavy, but crops mature earlier. The current value of uncleared land ranges from \$15 to \$30 an acre and that of cleared land from \$50 to \$150 an acre, depending on location and improvements.

SASSAFRAS FINE SANDY LOAM

The surface layer of Sassafras fine sandy loam consists of brown or light-brown fine sandy loam about 10 inches thick. This is underlain by yellow fine sandy loam which, within a depth of 20 inches, grades to reddish-yellow, yellowish-red, or dull-red, friable fine sandy clay. This layer of fine sandy clay is variable in thickness and in most places becomes more sandy or has a more open structure as a depth of 3 feet is approached.

In places the surface soil has a grayish cast, and in other places it is very dark. Patches of Sassafras sandy loam or Sassafras loam are included in mapping. Scattered gravel occurs in places over the surface and throughout the soil. Some of these gravelly patches occur in the northeastern part of the area and southeast of Swedesboro. In an included area of Sassafras fine sandy loam considerable sandstone is scattered over the surface. Some imperfectly drained Sassafras fine sandy loam occurs within areas of this soil, as does also some flat Sassafras fine sandy loam. These flat areas are near Delaware River, along some of the larger creeks, or contiguous to swamps or other areas of flat phase soils of the Sassafras series. In such land the lower part of the subsoil is generally slightly mottled, as the areas are only a few feet above tidewater and in many places

ground water is present within a depth of 3 feet. Typical areas of this flat soil are 3 miles southwest of Salem, north and southwest of Hancocks Bridge, and 2 miles southeast of Canton.

Typical areas of Sassafras fine sandy loam occur near Swedesboro, Harrisonville, Auburn, Jefferson, Mullica Hill, Whiglane, Shirley, Newkirk, Aldine, Harmony, Greenwich, Deerfield, and elsewhere.

Sassafras fine sandy loam occurs in undulating or gently rolling country. It is well drained. Probably 90 per cent of it is utilized for farming purposes, and the rest supports a growth of red, white, and black oaks, walnut, cedar, hickory, dogwood, and sassafras, and an undergrowth of laurel, huckleberries, and greenbrier.

Where cultivated, this soil is used for the production of corn, wheat, potatoes, and hay, supplemented by mid-season and late truck crops and some tree fruits and berries. Corn yields from 40 to 75 bushels to the acre, wheat from 20 to 35 bushels, potatoes from 200 to 350 baskets, and hay (timothy and clover) from $1\frac{1}{2}$ to 2 tons. Canning tomatoes yield from 5 to 8 tons to the acre, and all kinds of fruit do well.

Land values range from \$75 to \$125 an acre, depending on location and improvements.

This is an easy soil to work and it responds to careful fertilization. The maintenance of a good supply of organic matter is essential if the best results are to be obtained.

SASSAFRAS GRAVELLY SANDY LOAM

The surface soil of Sassafras gravelly sandy loam consists of yellow or grayish-yellow sandy loam or loamy sand containing conspicuous quantities of small, well-rounded quartz gravel. This is underlain by yellow, friable, gravelly loam or heavy sandy loam which grades, usually within a depth of 20 inches, to yellowish-red or reddish-yellow gravelly loam or gravelly clay. The clay generally becomes more open and less compact as the depth approaches 3 feet. The gravel present consists of small, rounded, white or stained quartz gravel, most of which is less than 1 inch in diameter although in places some of it is about 2 inches in diameter. Mixed with the gravel in places are small fragments of cemented sand or, as it is locally called, "iron crust."

Some variations as to color and material occur throughout the distribution of this soil. In places, the surface soil is dark-brown gritty loam, containing gravel; in others, it is reddish-yellow gravelly sand; in still others it is gray gravel. In other places the different horizons of the soil may outcrop on the surface.

Sassafras gravelly sandy loam occurs largely on the terraces in the eastern part of the area, although some areas are elsewhere. Typical areas are in the vicinity of Fairton, Bridgeton, southeast of Swedesboro, and elsewhere.

Most of the smaller areas are rather rolling and occur on ridges, hills, knobs, and stream slopes. The larger areas are in gently rolling country. Sassafras gravelly sandy loam is generally well drained, but where it occupies ridges, slopes, and hills, the drainage is excessive and the surface is badly worn or deeply furrowed by wash or erosion. Much of this material is used for surfacing the secondary roads of the area, and gravel pits are numerous.

Probably 60 per cent of this soil is used for farming. The rest of it supports a mixed growth of scrub oak, some hickory, pine, and dogwood, and an underbrush of laurel, sassafras, huckleberries, and various greenbriers. It is cultivated to such general crops as corn, rye, alfalfa, and hay, supplemented by mid-season truck crops and orchard products. Corn yields from 20 to 50 bushels to the acre and hay (timothy and clover) from one-half to $1\frac{1}{2}$ tons. Most of the rye is turned under as green manure. Alfalfa yields from $1\frac{1}{2}$ to 3 tons, potatoes from 90 to 200 baskets, canning tomatoes from 5 to 7 tons, and peppers 75 barrels to the acre.

In addition to the crops enumerated, small patches of asparagus, sweet corn, onions, sweet potatoes, okra, Lima beans, rhubarb, and peas are produced. All these crops do well but do not mature so early as on Sassafras loamy sand. Much of this soil is utilized for the production of peaches, apples, pears, and cherries. All kinds of fruit do well, and it would seem that the acreage in orchards could be profitably increased. Most of the soil is well located for fruit growing, being generally on the highest uplands where it is more likely to be free from late frosts in spring. Its compact substratum also retards early spring growth.

This land ranges in value from \$15 to \$125 an acre, depending on location and improvements. Favorably located cleared land brings the highest prices.

The organic-matter content of this soil is far from adequate. Organic matter could be incorporated in the form of barnyard manure or green manure. The rye crop is very light, and although most of it is turned under to improve the soil, a mixture of rye and vetch might give better results.

SASSAFRAS SAND

Sassafras sand consists of yellowish-brown or light-brown sand from 3 to 8 inches thick, underlain by orange-yellow sand which becomes reddish yellow near a depth of 3 feet.

Some variations occur in the color of the surface and subsurface material. In places the soil to a depth of a few inches is white or grayish white and the upper part of the subsoil is yellow, grading below to reddish-yellow sand. Such areas occur mostly in the forested parts of the "barrens" on some of the steeper slopes. In other places the upper part of the subsoil is yellow, the reddish-yellow color occurring only at a depth of about 3 feet. In many places well-rounded quartz gravel and pieces of ferruginous sandstone are present in the subsoil. Where considerable gravel occurs on the surface of large areas, the areas are indicated on the accompanying soil map by gravel symbols. Such areas are $1\frac{2}{3}$ miles north of Whiglane and $2\frac{1}{2}$ miles southwest of Aldine.

Some small patches of Norfolk sand are included in mapped areas of this soil. In these, the surface soil is yellow or grayish-yellow and the subsoil is pale yellow. Such areas occur 1 mile northwest, $1\frac{2}{3}$ miles north, and 2 miles northeast of Pecks Corner. Included narrow strips known as coastal beach show a greater range in texture and color than typical Sassafras sand. They have no agricultural value at present. A few areas of Sassafras fine sand are also included in mapping. The town of Bridgeport is on this kind of soil.

Sassafras sand is widely distributed in the area. A large body is south and west of Pecks Corner in that section known as the Barrens. Areas are undulating or rolling. Although there are places where slopes are steep, most of the land allows the use of all kinds of labor-saving machinery. Drainage is good, and in places where the water table is comparatively deep subsurface drainage is excessive and crops frequently suffer during periods of drought.

Probably 50 per cent of this soil is utilized for farming. The rest of it supports a growth of small, scrubby trees, various oaks, pine, dogwood, wild cherry, and chestnut, and an undergrowth of mountain and sheep laurel, huckleberry, sassafras, and greenbriers. Such land affords only scant pasturage. The timber is valuable only for firewood. Now that the production of truck crops is becoming more and more the dominant industry, this early soil could be utilized to advantage.

Cultivated areas of Sassafras sand are used principally for the production of early truck crops and corn and forage crops for the feeding of livestock on the farm. Most of the homes have a small orchard in which peaches, cherries, plums, or apples are grown. The truck crops include tomatoes, peas, beans, eggplant, peppers, potatoes, sweet potatoes, sugar corn, asparagus, watermelons, and cantaloupes, all of which do well and mature early.

Corn yields from 30 to 50 bushels to the acre, potatoes from 75 to 150 baskets, sweet potatoes from 150 to 200 bushels, and tomatoes from 300 to 500 baskets. Alfalfa and crimson clover seem to do well. Most crops grow better on this soil in a wet year.

The current values of cleared land range from \$75 to \$150 an acre, depending on location and improvements. Some land in timbered sections can be bought for \$30 an acre.

The recommendations suggested for Sassafras loamy coarse sand are applicable to this soil.

Sassafras sand, flat phase.—The surface soil of the flat phase of Sassafras sand consists of grayish-brown or yellowish-brown sand from 5 to 10 inches thick. This is underlain by orange or reddish-yellow sand which in most places continues to a depth of more than 3 feet. In depressions or low areas the lower part of the subsoil is slightly mottled.

Sassafras sand, flat phase, occurs along Delaware River and the larger creeks or is adjacent to tidal or reclaimed marsh, particularly southwest and north of Bridgeport, northwest of Paulsboro, and in the vicinity of Thompsons Point.

This soil occurs in flat or slightly undulating country and most areas are at a level comparatively close to that of the water table. Most of the land is cleared and cultivated. It is used for the same crops and managed in about the same manner as typical Sassafras sand. Crops do not mature so early on it, although the yields are said to be better.

SASSAFRAS COARSE SAND

The surface layer of Sassafras coarse sand is brownish-gray coarse sand from 5 to 8 inches thick. This grades to reddish-yellow coarse sand which commonly extends to a depth greater than 3 feet. In some of the cultivated fields the surface soil is brown to a depth of 8

inches. The subsurface layer in many places is pale yellow and, with increasing depth, takes on an orange or reddish cast so that as the depth approaches 3 feet the material is reddish-yellow coarse sand.

This is one of the inextensive soils of the area. It occurs near Mickleton, Alloway, and Pecks Corner. In some areas some gravel is scattered over the surface. Such areas are shown on the map by gravel symbols.

Sassafras coarse sand occurs in undulating or gently rolling country and is generally well drained. About 50 per cent of it is utilized for farming. The remainder supports a tree growth of blackjack, white, chestnut, and post oaks, pine, chestnut, wild cherry, and dogwood, and such undergrowth as sassafras, huckleberry, mountain and sheep laurels, and various greenbriers.

This soil is generally cultivated to corn, potatoes, and truck crops. Unless the seasons are very favorable the yields of corn and potatoes are light. This is an excellent soil for early truck crops, as these get an early start and mature early.

There seems to be very little difference between this soil and Sassafras sand with reference to the time of maturity of field crops, and little difference between it and Sassafras loamy coarse sand except that the latter is slightly more productive.

The value of cleared land of this kind ranges from \$75 to \$100 an acre, depending on the location and improvements. Some of the timbered land can be bought for prices ranging from \$20 to \$50 an acre, depending on the value of the timber for wood lots. Very little merchantable timber remains.

Turning under leguminous forage and heavy applications of barnyard manure would do much to improve the water-holding capacity of this soil and would materially increase crop yields.

SASSAFRAS LOAMY COARSE SAND

The surface soil of Sassafras loamy coarse sand consists of brown loamy coarse sand about 8 inches thick. This rests on reddish-yellow coarse loamy sand which commonly continues to a depth of 3 feet. The upper part of the subsoil is pale yellow, grading to reddish yellow in the lower part.

Included with mapped areas of this soil are a few small areas of Sassafras loamy coarse sand, flat phase. These are contiguous to swamps or watercourses, such as occur southwest of Fairton. Sufficiently large areas having a conspicuous quantity of small rounded quartz gravel on the surface are indicated on the map by gravel symbols. Some of these areas occur north of Bridgeton. This gravelly soil has about the same productive value as the typical soil.

Typical areas of Sassafras loamy coarse sand occur in the southwest part of Paulsboro, northwest of Pecks Corner, northwest of Jericho, southeast of Roadstown, and in many other places.

This soil occupies undulating or rolling country and is well drained. In places, particularly where the water table is comparatively deep, the subsurface drainage is excessive and crops frequently suffer during periods of drought.

Probably 70 per cent of this land is under cultivation. The rest of it supports a mixed growth of scrub oak and pine. Cultivated areas are devoted to the production of early truck crops, such as

tomatoes, asparagus, green peas, beans, eggplant, peppers, sweet corn, watermelons, and cantaloupes, together with corn, potatoes, sweet potatoes, and hay or forage crops. The yields are slightly better on this soil than on Sassafras coarse sand, and it holds up better during dry weather. There seems to be very little difference between the productive value of this soil and of Sassafras loamy sand.

Sassafras loamy coarse sand has about the same selling value as Sassafras loamy sand, and recommendations for improvement are the same for both soils.

COLLINGTON SANDY LOAM

Collington sandy loam consists of brown loamy sand or sandy loam underlain, at a depth varying from 8 to 12 inches, by friable, sandy clay which commonly continues to a depth of more than 3 feet. The subsoil contains enough greensand marl to give a decided greenish cast to the yellow subsoil. A greenish-yellow or greenish-brown color results.

In places, the lower part of the subsoil is lighter in texture and more sandy, and in other places the subsoil is heavier and comprises a layer of greenish clay or sandy clay with reddish-brown mottles. In other included patches gravel is present on the surface. Where such areas are sufficiently extensive they are indicated by gravel symbols on the map. These areas might be properly described as Collington gravelly sandy loam. They occur north of Jefferson, south and southwest of Swedesboro, and southwest of Harrisonville. The gravel seems to have little influence on the productivity of the soil, but it is a little hard on the farm implements. Some farmers think that crops do not suffer so much from drought on the gravelly as on the typical soil.

Collington sandy loam is the most extensive member of the Collington series. Typical areas are in the north-central and north-eastern parts of the area. It occurs northeast of Clarksboro, northwest of Mickleton, and north, northwest, and west of Jefferson.

Areas of Collington sandy loam are undulating or gently rolling. Drainage is good, and in patches on slopes the drainage is excessive and the surface soil has been wholly or partly removed by soil wash or erosion. Probably 70 per cent of this soil is utilized for agricultural purposes. The rest supports a mixed growth of various oaks and wild cherry, gum, ash, poplar, and some chestnut and pine.

Cultivated areas are devoted to the production of such general farm crops as corn, wheat, potatoes, and hay (timothy and clover), supplemented by mid-season and late truck crops, such as canning tomatoes, sweet corn, cabbage, eggplant, and peppers. Nearly every home has a few apple, peach, cherry, and plum trees. A good many small patches of alfalfa were seen on this soil, and this crop appears to do unusually well. The acre yields reported for corn range from 40 to 60 bushels, for wheat from 15 to 20 bushels, and for hay from 1 to 1½ tons. Canning tomatoes yield from 5 to 8 tons and potatoes from 150 to 175 baskets to the acre.

A comparison between Collington fine sandy loam and Collington sandy loam indicates that the former is more productive of general farm crops. Although the latter soil produces truck crops somewhat earlier than does Sassafras sandy loam, reports seem to indicate that it is less desirable. The subsoils of the Collington soils are generally heavier and more dense, but they contain much greensand marl

which is considered by many farmers as a very valuable addition. The Collington soils probably would be more productive if heavy applications of commercial fertilizers were made.

Collington sandy loam is an easy soil to work and appears to withstand rather protracted periods of dry weather.

Land of this kind is sold at prices ranging from \$100 to \$175 an acre, depending on location and improvements.

The suggestions made for the improvement of Sassafras sandy loam would be applicable to this soil.

Collington sandy loam, low greensand-content phase.—The surface soil of this phase of Collington sandy loam consists of brown or light-brown loamy sand or sandy loam from 8 to 12 inches thick. This rests on yellow or yellowish-brown friable sandy clay which in most places continues to a depth of 3 or more feet. The presence of some greensand marl in the subsoil makes the boundaries rather difficult to distinguish between this soil and typical Collington sandy loam and between this soil and typical Sassafras sandy loam. In many places the subsoil of this soil is more sticky when wet than is that of the typical Sassafras soil.

Areas of this soil include patches of Collington sandy loam, of Sassafras sandy loam, and of gravelly sandy loam. The largest gravelly areas are indicated on the accompanying soil map by gravel symbols. Such areas are conspicuous southwest of Swedesboro and in the vicinity of Harrisonville.

Areas of the low greensand-content phase of Collington sandy loam occur largely in the northeastern part of the area, usually in close association with other Collington soils. Typical areas are southeast of Clarksboro, northwest of Mickleton, and south and southwest of Mullica Hill.

Areas of this soil range from undulating to gently rolling and allow the use of all kinds of improved farm machinery. Drainage is generally well developed and in patches, particularly on some of the steeper slopes, is excessive and surface wash or erosion has removed the surface soil. Nearly all of this soil is utilized for agricultural purposes. The methods employed and crops grown are very similar to those on Sassafras sandy loam. The current value of this soil ranges from \$75 to \$150 an acre, depending on location and improvements. The recommendations for Sassafras sandy loam are applicable to this soil.

Collington sandy loam, deep phase.—The surface soil of the deep phase of Collington sandy loam is brown or light-brown loamy sand or light sandy loam from 8 to 12 inches thick. This rests on yellow loamy sand or light sandy loam which, below a depth of 20 inches, grades to greenish-yellow, olive-drab, or greenish-brown sandy clay. The material of the lower part of the subsoil varies from rather friable to heavy. In many included areas the material is low in content of greensand. Such areas are southeast and west of Jefferson, north, northwest, and southeast of Swedesboro, northwest of Harrisonville, and northwest and north of Woodstown. Patches of Collington loamy sand and Collington sandy loam are included in mapping. Over the surface and throughout the soil of these patches there is, in places, a conspicuous quantity of small rounded quartz gravel. Where these areas are large enough, they are indicated on the map by gravel symbols. A small area south of Swedesboro consists of Collington

coarse sandy loam, deep phase. This differs little from Collington sandy loam, deep phase, in productive value.

The deep phase of Collington sandy loam is very extensive in the northern and northeastern parts of the area. It occurs in the eastern part and east of Clarksboro, north and northwest of Jefferson, and in numerous other areas. It occupies undulating or gently rolling country and is generally well drained.

About the same proportion of this soil as of Collington sandy loam is used for agricultural purposes. Practically the same crops are produced and the soil is managed in about the same way as Sassafras sandy loam, deep phase. This is considered a stronger soil than Collington loamy sand or Sassafras loamy sand. It withstands protracted periods of dry weather better because of the high water-holding capacity of the underlying layer of sandy clay or clay. Collington sandy loam is easy to work. It warms up early in the spring, and crops get an early start.

Current prices of this soil range from \$75 to \$150 an acre, depending on improvements.

COLLINGTON FINE SANDY LOAM

The surface soil of Collington fine sandy loam consists of brown fine sandy loam from 8 to 12 inches thick. This is underlain by yellowish-brown fine sandy loam which, within a few inches, grades rather abruptly to greenish-yellow, greenish-brown, or reddish-yellow fine sandy clay which commonly continues to a depth of about 24 inches where it grades to greenish heavy fine sandy clay or clay mottled with brown. In places this heavy layer in the lower part of the subsoil is entirely lacking, and the material is friable. Included with this soil, as mapped, are patches of Collington sandy loam and Collington loamy sand. In places gravel is present in the subsoil. Where gravel occurs on the surface of sufficiently large areas, the areas are shown on the map by gravel symbols. Two miles northwest of Woodstown an area of Collington fine sandy loam, low greensand-content phase, is included with this soil in mapping. This soil is very similar to the typical material except for a smaller greensand marl content.

Collington fine sandy loam occurs in the northern part of the area. Typical areas are north of Sharptown and north of Mullica Hill. The land is undulating or gently rolling, and drainage is good. On some of the steeper slopes drainage is excessive, and the surface soil has been wholly or partly removed by erosion.

Probably 80 per cent of this soil is cleared and used for farming. The rest supports a mixed growth of various oaks, with white and red oak predominating, together with wild cherry, ash, and some chestnut and pine. General farm crops, canning tomatoes, potatoes, and some mid-season and late truck crops are grown. The general farm crops are corn, wheat, and hay. The yields reported for corn range from 50 to 70 bushels, for wheat from 20 to 30 bushels, and for hay (mixed timothy and clover) from 1 to 1½ tons to the acre. The yields of canning tomatoes range from 5 to 8 tons, and of potatoes from 150 to 200 baskets to the acre. Cabbage, sweet corn, and eggplant are successfully produced on this soil.

The current selling price of Collington fine sandy loam ranges from \$10 to \$150 an acre, depending on location and improvements.

More frequent incorporation of organic matter would do much to maintain and increase crop yields.

COLLINGTON LOAMY SAND

The surface soil of Collington loamy sand consists of brown loamy sand from 6 to 10 inches thick. The subsoil is yellow or reddish-yellow loamy sand or sandy loam which continues below a depth of 3 feet and contains enough greensand marl to give it a distinctly greenish cast.

Included with mapped areas of this soil are two small areas of Collington sand which occur east and southeast of Jefferson along the eastern boundary of the area.

Collington loamy sand has the same general characteristics as Collington sandy loam but lacks its loamy texture in both the surface soil and subsoil. Typical areas occur near Clarksboro, Jefferson, Mullica Hill, Swedesboro, and Penns Grove. Areas are undulating or gently rolling, and drainage is generally good. The soil is easily cultivated, warms up early in the spring, and matures the crops early. It is not very retentive of soil moisture, and crops frequently suffer during periods of dry weather.

Probably about 80 per cent of this soil is utilized for farming. The rest supports a mixed growth of pine and scrub oaks. Cultivated areas are devoted principally to the production of early truck crops, but some general farm crops, such as corn, wheat, and hay, are grown.

Collington loamy sand has about the same productive value as Sassafras loamy sand, but the yields are somewhat lighter. When there is sufficient rainfall, good crops of corn, wheat, and hay are obtained, but the soil is generally considered too light for such crops and better adapted to early truck crops.

This land is currently valued at prices ranging from \$100 to \$175 an acre, depending on location with reference to transportation, and on improvements. Collington loamy sand could be improved by the incorporation of organic matter, which would make it hold moisture better and would increase and maintain crop yields.

Collington loamy sand, low greensand-content phase.—The surface soil of this phase of Collington loamy sand consists of brown loamy sand from 8 to 12 inches thick. This grades to yellow loamy sand containing some greensand. The next lower layer consists of heavier loamy sand or sandy loam having a faintly reddish cast below a depth varying from 20 to 24 inches. This material contains more greensand than the layers above. Most of the surface soil contains conspicuous quantities of marl, owing to the former practice of putting greensand marl on the surface as fertilizer.

Collington loamy sand, low greensand-content phase, occupies an intermediate position between typical Collington loamy sand and Sassafras loamy sand. The boundaries between soil of this phase and Collington loamy sand and Sassafras loamy sand are rather difficult to define, as the greensand content is the basis of separation. In places this soil has a scattering of gravel over the surface, and where this is concentrated in sufficiently large areas the soil is indicated on the map by gravel symbols.

Typical areas of this soil occur in the northeastern part of the area, near and in the village of Swedesboro, and northeast and north of

Woodstown. The land occupies undulating or gently rolling country and is generally well drained.

About 80 per cent of this soil is utilized for farming. The rest of it supports a mixed growth of pine and scrub oaks. The crops grown are the same as on Collington loamy sand and Sassafras loamy sand. The selling price of the three soils is about the same, and recommendations for improving the Collington and Sassafras soils apply to this soil.

COLLINGTON LOAM

The surface soil of Collington loam consists of brown or dark-brown loam from 8 to 12 inches thick. This is underlain by yellowish-red, brownish, yellowish, or reddish-brown loam or light clay loam which in most places, within a depth of 20 inches, grades to greenish-yellow or greenish-brown sandy or silty clay which typically continues to a depth of 3 or more feet. In places the lower part of the subsoil is stiff plastic clay or sandy clay; in other places it is lighter in texture and contains sticky greensand.

Included with this soil as mapped are an area of Collington loam, imperfectly-drained phase, an area, 4 miles southwest of Sharptown, that has some gravel scattered over the surface, and patches of Collington silt loam. The areas which occur north and southwest of Sharptown and northwest of Woodstown are imperfectly drained. Patches of Collington loam, low greensand-content phase, are also included. One such area is 3 miles southwest of Sharptown, and the other forms the northern part of Woodstown and extends eastward.

Collington loam occurs mainly in the northern part of the area in close association with other Collington soils. Several areas are southwest, north, and northeast of Sharptown. The areas are undulating or gently rolling, and drainage is in most places good.

Practically all of this soil is utilized for farming. Although it does not appear to be so productive as Sassafras loam, it is a strong soil for general farm crops. It is used principally for the production of corn, wheat, hay, and potatoes. Some dairy farms are located on this soil, and part of the land is utilized for pasture.

Corn yields from 50 to 80 bushels, wheat from 20 to 35 bushels, potatoes from 150 to 250 baskets, and hay (mixed timothy and clover) from $1\frac{1}{2}$ to 2 tons to the acre. The pastures are excellent and are said to be almost permanent.

In places, considerable trouble is experienced with potato scab. Some farmers find the sulphur treatment successful, and others depend on changing the potatoes from place to place, avoiding repeated production on the same fields for long periods. Although the use of lime is considered beneficial to this soil, care must be exercised in its use for potatoes, as it has a tendency to favor the development of potato scab.

Current land values range from \$75 to \$150 an acre, depending on location and improvements. Crop rotation and the maintenance of a good supply of organic matter will do much to maintain and increase crop yields.

Collington loam, low greensand-content phase.—The soil of this phase differs from the typical soil in that the subsoil contains enough greensand marl to give it a slight greenish cast in the lower part. The surface soil may also contain a conspicuous quantity of greensand,

but this was incorporated in the soil as a fertilizer. On a small included patch north of Sharptown, some gravel is scattered over the surface.

KEYPORT SANDY LOAM

The surface soil of Keyport sandy loam consists of grayish-brown or light-brown loamy sand or sandy loam that ranges in thickness from 8 to 15 inches. This is abruptly underlain by stiff, yellow, sandy clay which grades to stiff, heavy clay. Below a depth of 20 inches the lower part of the substratum is characterized by mottling of gray and yellow or of blue or bluish gray.

Keyport sandy loam includes patches of Keyport silty clay loam in which the surface soil has been removed by erosion, of Keyport loam, Keyport silt loam, and Keyport fine sandy loam. Areas of the fine sandy loam are 1 mile southeast of Quinton, 1 mile southwest of Alloway, and 3 miles southwest of Berrys Chapel. In some areas there is a conspicuous quantity of small, well-rounded gravel over the surface. Where the gravel is concentrated, the area is indicated by gravel symbols on the soil map.

Most of the typical Keyport sandy loam occurs in the central and southwestern parts of the area. Areas are north, northeast, south, and southwest of Alloway west of Aldine, and in the vicinity of Harmony. A large area is southwest of Berrys Chapel, and another is northwest of Canton.

Keyport sandy loam occupies undulating, slightly rolling, or hilly land, and drainage is generally good. In some places the drainage is excessive, and the underlying clay is exposed. In depressions the soil is deeper, and drainage is not so good.

Practically all of this soil is under cultivation. It is used and managed in very much the same way as Sassafras sandy loam, but is not considered so productive. During wet seasons the impervious lower subsoil material tends to hold moisture and retard growth, but this water-holding capacity is advantageous in dry seasons. Keyport sandy loam is very easy to work, but crops do not mature on it early, as on Sassafras sandy loam and Collington sandy loam.

Keyport sandy loam is used for the production of such general farm crops as corn, wheat, and hay, supplemented by potatoes, tomatoes, and some garden truck. The yields of corn range from 35 to 50 bushels, of wheat from 20 to 25 bushels, and of hay (timothy and clover) from 1 to 1½ tons to the acre. Canning tomatoes are said to do unusually well on this soil, and yields of 8 tons to the acre have been reported. Potato yields are only fair.

Current land values range from \$75 to \$150 an acre, depending on the location and improvements. The incorporation of organic matter and the more frequent use of lime would increase materially the productiveness of this soil.

Keyport sandy loam, deep phase.—The surface soil of Keyport sandy loam, deep phase is light-brown loamy sand or light sandy loam, from 5 to 15 inches thick. This is underlain by yellow heavy sandy loam or light sandy clay which with depth becomes pale yellow in color and more like sandy clay in texture but which in most places, at a depth varying from 20 to 30 inches, rests on yellow or pale-yellow stiff clay. Included with this soil are patches of Keyport sandy loam, Sassafras sandy loam, and Sassafras sandy loam, deep

phase, also a small patch of Keyport coarse sandy loam, deep phase. Typical areas of Keyport sandy loam, deep phase, are near Quinton, Alloway, and Canton, and patches occur throughout the central and southwestern parts of the area.

This soil occupies undulating, rolling, or hilly areas. Most of it is well drained, and the greater part of it is used for farming. It is very similar to Sassafras sandy loam, deep phase, but is not considered quite so productive. It is a better truck-farming soil than typical Keyport sandy loam, but is not so productive for corn, small grains, and hay.

Land values range from \$75 to \$150 an acre, depending on location and improvements. The organic-matter content should be increased if the best results are to be obtained.

KEYPORT LOAM

The surface soil of Keyport loam is light-brown or yellowish-brown loam about 8 inches thick. Below this is yellow loam or silty loam, which grades, at a depth ranging from 12 to 20 inches, to mottled pale-yellow and gray silty clay loam. This material in most places becomes heavier with depth and grades to brittle clay mottled with pale yellow and gray or bluish gray. This layer continues to a depth exceeding 3 feet. Within mapped areas of this soil hillocks of Sassafras sandy loam and depressions of Alloway silty clay loam occur.

Typical Keyport loam occurs in the central part of the area. It lies south and southwest of Woodstown, southwest and south of Sharptown, and includes the eastern part of the town of Alloway.

Keyport loam occurs in undulating or slightly rolling country. The drainage is good, and most of the soil is utilized for farming. It is managed and treated much as is Sassafras loam, but it is not considered so productive nor so dependable. Many people call it "clay-bottom land" and say it is a cold and backward soil, as crops are usually late in starting and maturing on it. The surface material is more compact than that of Sassafras loam. Keyport loam seems to be a difficult soil to put in good condition. The best results are said to be obtained in dry seasons. Corn, wheat, and hay are the principal crops, although a good proportion of the land is utilized for pasturage. The yields of corn range from 40 to 70 bushels, of wheat from 20 to 25 bushels, and of hay from 1 to 1½ tons to the acre. The pastures are said to be very good in a dry season.

The current value of land of this type varies from \$75 to \$125 an acre, depending on location and improvements.

This is an excellent soil for general farm crops. The incorporation of organic matter and the more frequent use of lime would be very beneficial.

KEYPORT SILT LOAM

The surface soil of Keyport silt loam is yellowish-brown or grayish-brown silt loam or heavy silt loam from 6 to 10 inches thick. This grades to pale-yellow silty clay loam which is underlain by stiff, heavy yellow clay, mottled with gray and bluish gray, the mottling occurring usually between depths of 18 and 25 inches. This heavy clay extends many feet below the surface.

Mapped areas of Keyport silt loam include patches of Keyport silty clay loam on the steeper slopes or knolls where the surface soil has

been removed by erosion. Patches of Keyport sandy loam, Keyport loam, and Alloway silty clay loam are also included.

Keyport silt loam occurs mostly in the central part of the area. Typical areas are west and southwest of Woodstown, southwest of Sharptown, and in the vicinity of Alloway.

Keyport silt loam occupies undulating or gently rolling country. In some places the surface is hillocky or hummocky, with intervening depressions. Most of the soil is well drained. It is considered a better soil than Keyport loam, as it is not so cold nor backward. The surface material is not generally so compact, and the soil can be worked more easily than Keyport loam. It is utilized and managed much as is Sassafra silt loam, but it is not considered quite so productive nor so dependable, although it is more dependable than Keyport loam.

Probably 80 per cent of this soil is utilized for farming. The rest of it supports a heavy growth of such trees as white, black, and red oaks, tulip poplar, wild cherry, hickory, locust, beech, dogwood, and gum. It is considered a strong soil for general farm crops. Corn, wheat, and hay are the main crops, but some of the land is used for pasture and home orchards.

Corn yields from 40 to 80 bushels to the acre, wheat from 20 to 30 bushels, and hay (timothy and clover) from 1 to 2 tons. The pastures are said to be almost permanent. Apples, pears, and cherries appear to do well.

Current land values range from \$75 to \$150 an acre, depending on location and improvements. This is one of the best soils in the area for general farm crops. More definite systems of crop rotation which will make provision for the growth of more cover crops and leguminous forage are essential if the productivity is to be maintained or increased.

KEYPORT SILTY CLAY LOAM

The surface soil of Keyport silty clay loam is grayish or yellowish-brown silty clay loam from 5 to 8 inches thick. This is immediately underlain by yellow silty clay which below a depth of 15 inches is mottled yellow and gray and which grades, within a depth of 3 feet, to stiff, heavy, pale-yellow and gray, or bluish-gray clay.

Keyport silty clay loam might be described as a washed or eroded phase of Keyport loam, of Keyport silt loam, or of Keyport sandy loam. Where the surface soil is partly removed, the intricate mixture of the surface material and underlying clay, by instruments of tillage, has developed a clay loam texture; where the surface layer has been entirely removed, the underlying clay crops out on the surface and Keyport silty clay loam has developed; and where erosion has been light and plowing shallow, Keyport loam, Keyport silt loam, or Keyport sandy loam has developed.

In places well-rounded quartz gravel is scattered over the surface, but not in sufficient quantity to interfere with crop production. Such areas are shown on the map by gravel symbols.

Keyport silty clay loam, one of the inextensive soils of the area, occurs largely in the central part. Areas are near Alloway, Alloway Junction, and Portertown. The soil occupies stream slopes or rolling

country. Drainage is good and in most places is excessive. The slopes are badly washed or eroded in places, exposing the underlying clay. In some places erosion has gone so far that the land has no agricultural value.

Most of this land is cleared, but the greater part of it is utilized for pasture land. Where cultivated it is used for such general farm crops as corn, wheat, and hay. The yields of corn reported range from 20 to 40 bushels and of wheat from 15 to 20 bushels to the acre. Hay yields about 1 ton to the acre. The wheat is said to be of excellent quality, although the yields are light.

This land is usually sold with contiguous soils, but when sold alone it brings from \$50 to \$100 an acre, depending on location.

On the smoother slopes more care should be taken to prevent erosion. Contour plowing and cultivation where intertilled crops are grown would do much to protect the slopes from washing, particularly when the plowing is deep. The beds would thus hold more water. Where slopes are rough and steep they should be reforested or utilized for permanent pasture.

ELKTON SANDY LOAM

The dry surface soil of Elkton sandy loam consists of whitish, light-gray, or dark-gray loamy sand or sandy loam from 6 to 12 inches thick. This grades to light-gray or bluish-gray sandy clay with yellow and rust-brown mottles. At a depth of about 30 inches, this layer grades to light-textured gray or mottled gray and yellow material. In places between the surface soil and subsoil proper there is a layer of material similar in texture to the surface soil, but more nearly white in color.

Included with mapped areas of Elkton sandy loam are patches of Elkton loam, Elkton silt loam, and Alloway sandy loam. Combined with this soil are a few areas of Elkton fine sandy loam, which has the same general characteristics as Elkton sandy loam and about the same agricultural value. Two small areas of this soil are south of Mullica Hill and another is north of Friesburg.

Elkton sandy loam is one of the inextensive soils of the area. Its distribution is wide, but most of it occurs in the north-central part of the area. A large area is located north of Mickleton, another is southwest of Bridgeport, and two are southeast of Cedar Grove.

Elkton sandy loam occurs in flat or depressed areas in which drainage has not been fully developed. In early spring most of this soil is very wet or is covered with water. It usually dries out during the summer. In some places drainage is partly developed and in others it is completely developed by the use of open ditches and tile.

Only a very small proportion of this soil is utilized. Probably 80 per cent of it is covered with a very heavy underbrush through which is a scattered growth of such trees as sweet gum, black gum, water and other oaks, maple, willow, holly, and bay. The underbrush includes gum, briars, vines, sassafras, laurel, huckleberries, and grasses.

Most of the cleared land is utilized for pasture. The drained areas are used for the production of corn, wheat, hay, and such truck crops as canning tomatoes, peppers, cabbage, onions, and strawberries. Elkton sandy loam is not so productive as the Sassafras soils, and crops on it usually mature much later. Crops are said to do best on it in dry years.

Land values range from \$50 to \$100 an acre, depending on location and improvements. The timbered areas are valuable in places as wood lots. To get the best results from this soil, drainage is imperative.

ELKTON LOAM

Typical Elkton loam consists of gray loam from 5 to 10 inches thick, underlain by almost white or bluish-gray loam which grades to heavier loam underlain by bluish-gray light silty clay loam or light sandy clay loam, mottled with yellow and rust brown. In many places the lower part of the subsoil is lighter in texture, and gravel is present within a depth of 3 feet.

Elkton loam includes patches of Elkton silt loam, Elkton sandy loam, Alloway loam, and areas having a gray surface soil resembling that of the Portsmouth soils. In a few places the subsoil, between depths of 20 and 24 inches, contains a thin layer of blue and yellow silty clay. Had this layer been of sufficient thickness, these patches would have been classed as an Alloway soil.

Elkton loam is one of the inextensive and rather unimportant soils of the area. It occurs in all parts of the area, but more particularly in the northern section. Typical areas are northeast of Clarksboro, southwest of Sharptown, and in other places throughout the area. The land is almost flat or depressed and is generally poorly drained. Most of it supports a heavy underbrush and light forest growth similar to that on Elkton silt loam.

Cleared land is used principally for pasture. Good corn and hay are grown in a few places where the drainage conditions have been improved.

ELKTON SILT LOAM

The surface soil of Elkton silt loam consists of gray silt loam from 5 to 12 inches thick. This is underlain by bluish-gray or almost white silt loam which, at a depth varying from 15 to 20 inches, grades to light bluish-gray or bluish-gray silty clay loam mottled with yellow.

The surface soil is very compact and contains very little organic matter, even in the timbered areas. The material of the lower part of the subsoil is heavier in places and approaches silty clay in texture, but in most places at a depth of about 3 feet the material is light sandy loam, sandy clay, or in a few places sand and gravel. Mapped areas of Elkton silt loam include patches of Alloway silt loam, Alloway silty clay loam, Elkton sandy loam, Elkton loam, and dark-gray soil which resembles the Portsmouth soils.

Elkton silt loam is one of the most important members of the Elkton series. It occurs in large areas, particularly in the northern and western parts of the areas surveyed. Typical areas are north of Clarksboro, southeast of Penns Grove, east of Pittsgrove, southeast of Newkirk, south of Shirley, and in other places. The soil occupies flat or depressed areas and is generally poorly drained. In early spring much of it is so covered with water that the areas resemble ponds or small lakes. These become dry as the season advances. On account of the compactness or comparative imperviousness of the substratum and the position of the land, water frequently remains on the surface for days after heavy rains. In such places the soil is alter-

nately wet and dry and might be described as semiswampy. Some effort has been made to improve the drainage conditions by the use of open ditches and tiling.

Probably 80 per cent of this soil is covered with underbrush and small trees. The underbrush consists of a tangle of vines, greenbriers, huckleberry, laurel, small bay, alder, sassafras, ferns, and grasses, and the trees are sweet gum, black gum, soft maple, water and other oaks, willow, bays, and in places, cedar and pine.

Where cleared this soil is used for pasture and the production of such general farm crops as corn, wheat, and hay, supplemented by occasional crops of tomatoes for canning. Corn yields from 20 to 40 bushels, wheat from 15 to 20 bushels, and hay from 1 to 2 tons to the acre. The yields of tomatoes are said to be heavy, but the crop usually matures late.

This is a rather difficult soil to manage and put in good condition. If plowed too wet it does not scour readily from the plow, and if plowed too dry it breaks up in clods.

Current land values range from \$50 to \$100 an acre, depending on location and improvements.

It would seem that the areas of drained land could be profitably extended and a strong soil developed for the growth of general farm crops. Liming and the incorporation of organic matter are essential, in addition to improved drainage.

ALLOWAY SANDY LOAM

The surface soil of Alloway sandy loam consists of dark-brown, grayish-brown, or dark-gray loamy sand or sandy loam about 8 inches thick. The upper part of the subsoil is mottled yellow or bluish-gray sandy clay which, at a depth of more than 20 inches, typically grades to stiff, plastic clay or sandy clay mottled with yellow and bluish gray. In places the soil is rather deep and the lower part is mottled yellow and bluish-gray sandy loam. In most places this grades to the underlying clay within a depth of 3 feet. In other places the soil is shallow, and sandy clay comes almost to the surface. Patches of Alloway silty clay loam, Alloway silt loam, and Alloway loam are also included.

Alloway sandy loam is one of the inextensive soils of the area. Typical areas are southwest of Harmony, west of Maskells Mill, northwest of Springtown, and in other places throughout the central part of the area surveyed. This land occurs in close association with the Keyport soils or other members of the Alloway series.

Alloway sandy loam occurs in flats or depressions. It is generally poorly drained, and very little of it is used for agricultural purposes other than pasture. Probably 50 per cent of it supports a mixed growth of trees and heavy underbrush, very similar to that on Alloway silty clay loam or Alloway loam. Corn, wheat, and hay are grown to a small extent.

Corn yields from 25 to 35 bushels to the acre, wheat from 15 to 25 bushels, and hay from 1 to 1½ tons.

This land is rarely sold alone unless it has a value for wood lots. Adequate drainage is essential to improve this soil.

ALLOWAY LOAM

The surface soil of Alloway loam consists of brown, dark-brown, grayish-brown, or dark-gray loam from 6 to 12 inches thick. This is underlain by bluish-gray loam or heavy loam mottled with yellow or yellowish brown which grades, at a depth varying from 15 to 20 inches, to stiff, yellow clay, with bluish mottles. In places, this clay grades within a depth of 3 feet to bluish-gray clay with yellowish mottles.

Included with mapped areas of Alloway loam are patches of the silty clay loam, sandy loam, and silt loam of the Alloway series. As areas approach the contiguous upland soils, the surface colors are more grayish, and the soil material looks very much like that of the Elkton soils.

Alloway loam occurs chiefly in the central part of the area where it is commonly associated with the Keyport soils. Typical areas are northwest of Greenwich, west of Harmony, in two patches west of Harmersville, and in other small spots throughout the central part of the area. This soil occupies flat or depressed areas and is imperfectly drained, although the drainage is, in general, a little better than on Alloway silty clay loam. In some patches drainage has not been established, but in many places open ditches and tile have been installed.

Probably not more than 20 per cent of this soil is in timber. The forest growth is practically the same as that on Alloway silty clay loam. The soil is utilized for pasture and such farm crops as corn, wheat, and hay, and an occasional crop of tomatoes. Corn yields from 35 to 40 bushels to the acre, wheat from 18 to 25 bushels, and hay (mixed timothy and alsike clover) from $1\frac{1}{2}$ to 2 tons. The tomatoes grown are Greater Baltimore, Trophy, and Cumberland varieties, and yields average about 7 tons to the acre. The soil is said to be rather difficult to manage, as it puddles if not plowed when moisture conditions are right.

This land is currently held at prices ranging from \$50 to \$100 an acre, depending on location and improvements. Little of it is sold alone.

Adequate drainage, the incorporation of organic matter, and liming are essential for the improvement of this soil.

ALLOWAY SILTY CLAY LOAM

The surface soil of Alloway silty clay loam, to a depth ranging from 6 to 12 inches, consists of dark-brown, grayish-brown, or dark-gray silty clay loam mottled with rust brown. This grades to grayish-brown or brownish-gray silty clay mottled with bluish gray and rust brown which, in turn, grades, usually between depths of 20 and 30 inches, to yellow, plastic, sticky clay, mottled with bluish gray and reddish yellow. This material is in most places continuous to a depth of more than 3 feet.

In some places the surface soil is rather deep, has a high content of organic matter, and might be described as mucky. In other places it is shallow and very compact, and the underlying bluish-gray silty clay is present within 10 inches of the surface. In such places the surface colors are very similar to those of the Elkton soils. Areas of the sandy loam, silt loam, loam, and clay members of the Alloway series are also included. In an area $2\frac{1}{2}$ miles south of Woodstown the soil represents a transition between the Alloway

soils on one hand and the Keyport soils on the other. It was classified as Keyport silty clay loam but, as it is of very small extent, it was included with Alloway silty clay loam in mapping.

Included also with Alloway silty clay loam are areas of Portsmouth silt loam and Portsmouth silty clay loam. These have the characteristic surface soils of Portsmouth loam but have subsoils more like those of the Alloway soils. Portsmouth silty clay loam is the more important as regards distribution, as it occurs in several areas. These inclusions in the Alloway silty clay loam have all the general characteristics of the Alloway soils, except that the surface soils are black.

Alloway silty clay loam occurs throughout the central part of the area south of Woodstown, west of Yorktown, in the vicinity of Alloway and Alloway Junction, and southwest toward Harmersville. In most places it is closely associated with the Keyport soils. One of the largest areas is mapped 2 miles west of Yorktown. Other areas are south of Alloway Creek and Alloway, but these are smaller and more spotted. This spotted condition occurs also in areas west of Maskells and Davis Mills. Other small areas are in the vicinity of Harmersville and throughout the central part of the area surveyed.

Alloway silty clay loam occurs in flat or depressed areas, and the drainage is generally poor. In early spring many of these places are covered with water. During the summer most of them become dry, but the soil is so heavy and the fall is so slight that water frequently remains on the surface for some time after rains. About 70 per cent of this soil supports a mixed growth of timber and heavy underbrush. Some of the trees noticed were maple, various kinds of oaks, sweet and black gum, persimmon, holly, bay, willow, sycamore, cedar, and pine. The trees, in general, on the Alloway soils are much larger than on the Portsmouth soils, and excellent merchantable timber must have been removed in the past, judging from the number of big stumps left. The undergrowth is generally much thicker and more tangled on the edges of the areas than in the center. Greenbrier, grapevines, blackberry bushes, sassafras, swamp huckleberry, mountain and sheep laurel, tussocks of coarse grass, and occasional patches of bulrush are seen. In the southern part of the area some of the patches of Alloway silty clay loam are called cedar swamp, but the cedar has been largely removed.

The cleared part of Alloway silty clay loam is utilized for pasturage or for the production of corn, wheat, and hay. The yields of wheat on well-drained land range from 15 to 30 bushels, of corn from 30 to 60 bushels, and of hay from 1 to 2 tons to the acre. The best yields are obtained from those fields that are best drained, particularly during dry years. The pastures are said to be almost permanent.

Alloway silty clay loam is a difficult soil to manage. It adheres to the plow if it is broken when too wet and breaks into clods if it is plowed when too dry.

Patches of this soil are rarely sold alone. Adequate drainage, the frequent use of lime, and thorough tillage would add materially to the productiveness of the land.

SHREWSBURY SANDY LOAM

The surface soil of Shrewsbury sandy loam is gray, brown, or dark-brown sandy loam from 6 to 12 inches thick. The subsoil consists of gray or light-gray sandy clay which, between depths of 15 and 24

inches, grades downward to greenish-gray sandy loam or sandy clay mottled with rust brown or red. Greensand marl is present in this soil, usually becoming more conspicuous with depth. The mottling so characteristic of the subsoils of this series results largely from the greensand present and the condition of the drainage.

Included in mapped areas of this soil are patches in which the surface soil is gray and the subsoil is mottled gray, yellow, and brown or greenish yellow. Variations in the subsoil include layers or pockets of sand or loamy sand ranging in color from yellow to gray or green. Small areas of Shrewsbury fine sandy loam are also included. One of these occurs 1 mile southwest of Clarksboro.

In its distribution Shrewsbury sandy loam is generally associated with the Collington soils. It occurs in a few patches in the most eastern part of the area. Two small patches are northwest of Mickleton, another is about 1 mile northeast of Harrisonville, and others are southwest of Auburn. Areas occur in flats or depressions, and although imperfectly drained the land is better drained than Keansburg sandy loam. About one-half of the land is utilized for farming. The rest of it supports a mixed growth of sweet gum, sycamore, various oaks, and some maple. Where drainage has not been adequately developed, the land is utilized for pasturing cattle and work animals, but where drained it is used for grass, corn, potatoes, tomatoes, cabbage, strawberries, and peppers.

Corn yields from 40 to 60 bushels, potatoes from 75 to 100 bushels, and hay (timothy and clover) from $1\frac{1}{2}$ to 2 tons to the acre. The truck crops are said to yield well, but they are likely to be a little late for the earliest markets.

Current land values range from \$75 to \$150 an acre, depending on location and improvements. Adequate drainage should be established on all of this soil. Liming and incorporation of organic matter would do much to improve its physical condition and would add materially to its productiveness.

SHREWSBURY LOAM

The surface soil of Shrewsbury loam is brown or grayish-brown loam from 5 to 8 inches thick. The upper part of the subsoil is mottled bluish-gray and yellowish-brown silty loam or silty clay loam and is underlain, at a depth ranging from 20 to 36 inches, by greenish-yellow or mottled reddish-yellow clay. The degree of mottling depends on the drainage. The better drained areas show less mottling than those in which the drainage is undeveloped. The greenish color results from the presence of greensand marl which is conspicuous in the lower part of the subsoil.

Included with this soil are some patches of Shrewsbury fine sandy loam and Shrewsbury silt loam which have the same general characteristics but differ in texture. In patches this soil is very similar to Elkton loam, having the same gray or ash-gray surface soil and mottled greenish subsoil, but the marl content increases with depth.

Although Shrewsbury loam is more widely distributed than the sandy loam of this series, it is of only small extent. It occurs in close association with soils of the Collington series, largely in the northeastern part of the area surveyed. Areas are north of Woodstown, northeast of Mullica Hill, southeast of Harrisonville, northwest of Mickleton, and southeast and east of Bridgeport.

Shrewsbury loam occurs in flat or depressed areas, and most of it is imperfectly drained. Drainage is effected in places by the use of open ditches or tile. The soil does not warm up early in the spring. Great care has to be exercised in preparing it for crops, for if it is plowed when too wet it adheres to the plow and tends to puddle, and if it is plowed when too dry, it breaks into clods and is brought into good tilth only with difficulty. Most of the soil is compact and close even in those areas that have a heavy undergrowth and a scattered growth of trees.

Only a small proportion of this soil is utilized for farming. Most of it is covered with brush or a thin forest growth. When the forest has been removed and the land has been well drained, it is used for the production of corn and hay. Imperfectly drained areas are used for pasture. The yields of corn range from 35 to 60 bushels and of hay from 1 to 2 tons to the acre.

In uncleared areas this land is covered by a thick undergrowth of greenbrier, huckleberries, laurel, sassafras, hanging vines, and grasses. There is a scattered growth of various oaks, soft maple, magnolia, willow, gum, pine, and cedar trees. Areas of this soil are rarely sold alone.

Establishment of good drainage, the use of lime, and the incorporation of organic matter would make this soil valuable for general farm crops.

COLTS NECK LOAMY SAND

The surface soil of Colts Neck loamy sand consists of reddish-brown loamy sand from 6 to 10 inches thick. This is underlain by reddish-yellow, yellowish-red, or deep-red loamy sand which commonly continues to a depth of more than 2 feet. Below this there is enough greensand to give a greenish cast to the deeper substratum. Many slaty ferruginous rock fragments occur on the surface or throughout the soil to a depth of 3 feet. Included with Colts Neck loamy sand is an area of Colts Neck sandy loam which lies south of Auburn. This consists of a reddish-brown sandy loam surface soil underlain, at a depth of about 10 inches, by heavy brownish-red or yellowish-red sandy loam or light sandy clay which, at a depth of about 24 inches, grades to greenish-yellow or greenish-brown friable sandy clay containing a conspicuous quantity of greensand marl.

Colts Neck loamy sand is one of the inextensive soils of the area surveyed. It occurs in patches in association with the Collington soils, mostly in the northeastern part of the area surveyed. A large continuous area is just south and southeast of Swedesboro on the northern slope of the lake and tributary stream, and numerous small patches are southwest of this place. Colts Neck loamy sand occurs on slopes or rather conspicuous knolls or hills. The areas are well drained, even excessively drained in places, and the surface is badly furrowed by excessive soil wash. Where the surface is not too badly eroded, this is considered an excellent soil for fruit. All kinds of truck crops thrive, but the relief is usually such that they can not be so economically produced as on the more level land. The soil is too light for general farm crops but is admirably adapted to the production of truck crops and fruit, for which it is generally utilized.

Colts Neck loamy sand warms up early, is easy to work, and crops mature on it as early as on any soil in the area.

This land is valued at prices ranging from \$75 to \$150 an acre, depending on the condition and location with respect to markets.

Greater effort should be made to protect the slopes from erosion. Where the relief is not favorable to the economic production of field crops the land should be utilized for fruit trees or forest.

KEANSBURG SANDY LOAM

The surface soil of Keansburg sandy loam consists of black loamy sand or light sandy loam from 6 to 12 inches thick. Below this is gray, white, or mottled yellow and gray loamy sand which grades, at variable depths, to greenish pale-yellow sandy loam which in turn grades, at a depth ranging from 20 to 36 inches, to bluish-green, pale-green, or greenish-yellow light sandy clay.

Where this soil borders other soils, the black changes gradually to brown, whereas near the streams the surface is more intensely black and the soil is more mucky. In places scattered quartz gravel occurs in the deeper part of the subsoil. Included in mapped areas of this soil are patches of Keansburg silty clay loam too small to justify separate mapping.

Keansburg sandy loam occurs mostly in the northeastern part of the area, where it is closely associated with the Collington soils. The largest and most important area, which is also the most westerly, is northwest of Sharptown. Areas occupy flats or depressions, generally close to streams, and most of the land is imperfectly drained. In most places water is present within a depth of 3 feet. Some effort has been made in places to improve drainage by open ditches or tile.

Uncultivated areas support a mixed growth of water oak, sweet gum, willow, wild cherry, and sycamore, and grapevine, poison ivy, and Virginia creeper are abundant in the underbrush. Where the timber has been partly removed, the soil is utilized for pasturing milk cows and work animals.

Where drained, Keansburg sandy loam is considered a strong soil for corn and grass, and much of it is under cultivation. Yields of 80 bushels of corn and 2 tons of timothy and clover hay to the acre have been reported, and such garden crops as lettuce, onions, celery, cabbage, and strawberries are said to do well.

This land is rarely sold alone.

Keansburg sandy loam can be brought to a high state of productivity if good drainage is established. In other parts of the State it is considered a very valuable soil. Where drainage can not be economically effected, the land could be used for pasture or for forestry.

WOODSTOWN SANDY LOAM

The surface soil of Woodstown sandy loam, to a depth of about 10 inches, consists of light-brown or brown loamy sand, sandy loam, and, in some places, heavy sandy loam. This is abruptly underlain by mottled yellowish-brown or yellow and bluish-gray sandy clay, which in most places grades, below a depth of 20 inches, to mottled bluish-gray and yellow friable and somewhat plastic clay. The bluish-gray color predominates in the lower part of the subsoil. In most places within a depth of 4 feet, the clay rests on sand or gravel or a combination of sand and gravel.

Mapped with Woodstown sandy loam are small areas of Woodstown fine sandy loam and Woodstown very fine sandy loam. These soils have the same general characteristics as Woodstown sandy loam and have about the same agricultural value.

Woodstown sandy loam and the included fine sandy loam constitute an unimportant and inextensive soil. Typical areas of the sandy loam are southeast and south of Pennsville and northwest and southeast of Whiglane. This soil is generally closely associated with the Sassafras soils and represents a condition intermediate between the Sassafras and Elkton soils.

Woodstown sandy loam occurs in flat, depressed, or sloping areas close to stream heads or tidal marsh. The subsurface drainage is imperfectly developed and in many places water is found within a depth of 3 feet. Some effort has been made in places to improve drainage conditions by open ditches and tile.

Most of the land is cleared. It is used principally for pasturing cattle and work animals. The better-drained areas are used for the same crops as Sassafras sandy loam and are treated in much the same manner, although they are not considered so productive. Good crops of corn and tomatoes were seen, but this is said to be a poor soil for potatoes.

This soil is usually sold with contiguous soils. Adequate drainage is necessary if the best results are to be obtained.

WOODSTOWN LOAM

Woodstown loam has a brown or light-brown loam surface soil from 6 to 10 inches thick, underlain by pale-yellow or yellow loam which rarely exceeds a depth of 15 inches where it grades to yellowish-gray, grayish-yellow, or mottled bluish-gray and yellow sandy clay or sandy clay loam. As the depth approaches 3 feet, the grayish colors usually predominate and in places there is a layer of gray sand.

Woodstown loam includes patches of Woodstown silt loam, Woodstown sandy loam, and Elkton loam. The soil is a combination of the Sassafras and Elkton soils. The surface soil is like that of the Sassafras soils and the subsoil like that of the Elkton.

Woodstown loam is the most important member of the Woodstown series in this area, although it is one of the inextensive soils. Typical areas are southwest and northwest of Whiglane, and in many other places. Some are near tidal marsh and reclaimed tidal marsh.

This soil occurs in flat or depressed areas. Drainage has not been generally developed in the subsoil, and in many places water is present within a depth of 3 feet.

Some effort has been made to drain the soil by open ditches or by the use of tile. Where it is drained it produces good crops of corn, wheat, and hay. It is managed in much the same way as Sassafras loam or Sassafras silt loam, but it can not usually be worked so early in spring on account of the drainage conditions. Crops do not mature on it so early as on the Sassafras soils, but it is a much better soil than Elkton loam. The greater part of it is cleared and used for pasture.

Land of this type is usually sold with contiguous soils. Drainage could profitably be extended. Where drainage is established, liberal applications of lime are said to be very beneficial.

PORTSMOUTH LOAMY SAND

Portsmouth loamy sand consists of black or dark-gray loamy sand from 5 to 10 inches thick underlain by whitish or grayish loamy sand which in most places prevails for 15 or 20 inches. The loamy sand is in many places mottled gray and yellow, or gray, yellow, and pale blue to a depth exceeding 3 feet. In places the whitish layer extends below a depth of 3 feet. Locally the black surface soil is underlain by sand having the characteristic colors of the Elkton soils. Included with mapped areas of this soil are patches of the sand, sandy loam, and loam members of the Portsmouth series. In some places, the lower part of the subsoil contains well-rounded quartz gravel.

Portsmouth loamy sand occurs in the northwestern and southern parts of the area and is one of the unimportant soils. One of the largest areas is east of Penns Grove, and patches occur northwest of Clarksboro and southwest of Bridgeport. The soil occupies flats or depressions, usually at the heads of, or contiguous to, streams. It is poorly drained throughout the year. The water table is usually less than 3 feet from the surface, except during periods of protracted drought.

Most of this soil is covered with brush through which is a scattering of sweet gum, maple, bay, willow, cedar, and pine. The underbrush is usually a tangle of vines, swamp huckleberry, laurel, fern, and coarse grasses, and on the outskirts of cultivated fields broom sedge, species of crabgrass, blackberry bushes, and grapevines are conspicuous.

Where the land has been cleared it is used as pasture for cattle and work animals, and in the better-drained parts contiguous to upland soils it is used for corn, hay, and garden truck.

This land is rarely sold alone. Where good drainage can be established, this ought to be an excellent soil for truck crops.

PORTSMOUTH SANDY LOAM

The surface soil of Portsmouth sandy loam is black or dark-gray sandy loam from 8 to 15 inches thick. The upper part of the subsoil is whitish, grayish, or dark-gray sandy loam which at a depth varying from 18 to 24 inches grades to sandy loam or light sandy clay, mottled gray and yellow, or gray, yellow, and pale blue. Below a depth of 3 feet the material is commonly light-colored sand, sand and gravel, or gravel.

In most places the surface soil has a high content of organic matter, and in places it might be described as mucky. Some of these places, particularly in the vicinity of Sheppards Mill, were once utilized for cranberry culture but are now abandoned.

Within the mapped areas of Portsmouth sandy loam are patches of Portsmouth sand, St. Johns loam, and Elkton sandy loam. An area of St. Johns sandy loam 3 miles southeast of Penns Grove and one of St. Johns loamy sand 2 miles south of Penns Grove are also included. In a few included areas of Portsmouth loam the black, very dark brown, or grayish-black surface soil of loam is underlain, at a depth varying from 6 to 12 inches, by gray, whitish, or bluish-gray loam or heavy sandy loam which grades to bluish-gray sandy clay mottled with yellow. This soil occurs in flat or depressed areas which are

generally poorly drained. It affords rather scant pasturage for livestock. Included small areas of Portsmouth silt loam occur west and northwest of Auburn.

Portsmouth sandy loam, in its typical development, occurs in the western and southern parts of the area. One of the largest bodies is about 3 miles southeast of Penns Grove, smaller ones are south, east, and southeast of Yorktown at the head of the stream, and one is located 4 miles southeast of Penns Grove. The soil occupies flats or depressions, and most of it is poorly drained. It is not important agriculturally, as most of it is covered with tangled brush and a scattered growth of oak, sweet gum, and maple. Some of the areas afford light pasturage, but drainage conditions restrict the utilization of this soil. In places where drainage has been developed by open ditches or tile, good results have been obtained with corn, hay, and truck crops. Strawberries do unusually well where drainage is good.

This soil is rarely sold alone, except where it is in demand as wood lots.

FRENEAU LOAM

The surface soil of Freneau loam typically consists of brown or dark-brown loam mottled with rust brown. This is underlain, at a depth ranging from 5 to 8 inches, by dark-blue loam or heavy sandy loam with some rust-brown mottles, which in most places grades, within a depth of 3 feet, to bluish-black silty loam. Where the subsoil is close to the surface, green and greenish-blue mottles are common.

There is considerable variation in texture and color. Patches of sand, sandy loam, silt, and even silty clay loam are present but are not of sufficient extent to warrant separation. In the wet, poorly drained, or marshy places the surface soil is commonly light-blue and rust-brown silty loam, which grades to dark greenish-blue or blue silty loam underlain by a deeper subsoil of blue-black silt loam. Nearer the uplands, where drainage is better, the surface soil is a little lighter in texture and is brown or mottled brown. The subsoil is green or blue or a combination of both colors.

Typical areas of Freneau loam are in the northeastern part of the area. Narrow bands of this soil are north, south, west, and southwest of Mullica Hill, along the headwaters of Raccoon Creek, Repaupo Creek, and Oldmans Creek. The soil is of alluvial origin and consists of material washed from the Collington soils or the greensand marl beds.

Occurring as flat areas adjacent to streams, Freneau loam is subject to overflow during floods. It is generally poorly drained, much of it being saturated throughout the year. For this reason, it has little agricultural value other than for pasture. The greater part of it supports a growth of alder, willow, bulrush, skunk cabbage, and a few sycamore, swamp maple, and sweet gum trees. With adequate drainage this would be a valuable soil for general farm crops. Under present conditions it is suitable only for pasture.

RECLAIMED TIDAL MARSH

Reclaimed tidal marsh comprises areas which have been protected from tidal inundation by extensive systems of dikes. The water is drained away by open ditches or dikes provided with one-way water

gates. Many of these areas are below the level of high tide and the meadows or cultivated fields are protected by rough dikes of mud reinforced on the tidewater side by facings of stone. These dike and ditch systems are maintained by cooperative organizations among the landowners. In addition to these large areas along Delaware River have been reclaimed by dredges operating in the river and pumping the material beyond the facing walls.

Considerable variation in color, structure, and degree of saturation occurs throughout the areas of reclaimed tidal marsh, particularly where the ditching is not complete. The surface material in places is mucklike or peaty, and in others it ranges from gray to dark-brown and is variable in texture. Gray seems to predominate in the pumped areas along the river and brown on more inland areas. Material of the inland areas is brown silty clay loam with some sand mottled with rust brown and dark ash gray. This grades to mottled dark bluish-gray and rust-brown silty clay loam, which is lighter colored near a depth of 3 feet.

It is reported that these areas are not immediately productive of crops after diking, and in places nothing could be produced for three years. The river soil material does not respond so quickly as that on the more inland areas. In places excellent crops of corn are produced, yields ranging from 50 to 100 bushels to the acre. Tomatoes, horseradish, lettuce, beets, strawberries, and alfalfa seem to do well. Most of this land is used as meadows for the production of salt hay.

TIDAL MARSH

The surface of tidal marsh is a mat of partly or entirely decomposed plant fibers and roots. This layer in places is more than 3 feet thick. Brownish-gray or bluish-gray silty loam or silty clay loam mottled with rust brown or reddish brown underlies this surface covering or comes to the surface in places. This commonly grades to dark bluish-gray silty clay loam or silty clay. The subsoil is strongly charged with hydrogen sulphide and is always saturated and oozy. In some places where the marsh approaches the uplands there has been some outwash of the upland soils, and materials of various texture are found.

Tidal marsh occurs along Delaware River and Delaware Bay and extends well back into the uplands along most of the larger tributary streams. The largest area is in the southern part of the area, near the mouth of the river.

Throughout the tidal marsh in islandlike areas where the marsh mat is more shallow marsh hay or salt hay grows. Probably about 4,000 acres are cut over each year for this hay, which sells in the local markets at prices ranging from \$8 to \$12 a ton. It is considered much more valuable for feeding purposes if it is cut before frost. Most of it is used for bedding livestock, and some is shipped to glass factories and other manufacturing plants, where it is used for packing. If the meadows are accessible, most of the hay is harvested during the summer, otherwise it is harvested in winter when the ground is frozen. Tidal marsh also includes some areas of freshwater marsh or areas flooded with fresh water.

MEADOW

Meadow represents a condition rather than a soil type. The material shows many different surface and subsurface colors and many textural variations, both laterally and vertically. It occurs at the heads of streams and drainage-way bottoms. It is generally imperfectly drained, although it represents better agricultural material than swamp. It is now largely used as pasture or grazing land and in places produces some corn and hay. With the development of better drainage some parts could be used for a wider variety of crops.

SWAMP

Swamp is the name applied to low, wet areas bordering the streams and the broader flats about the heads of the watercourses. Most of these areas are saturated throughout the year, although they contain small hummocks of higher land.

Most of the swamp consists of muck ranging in thickness from a few inches to 2 feet. This black muck is underlain by brown muck or peat in the area west of Repaupo along the tidal stream. It supports a growth of maple, cat-tail, ironweed, fern, smartweed, touch-me-not, Spanish needle, and eelgrass. In an area $9\frac{1}{2}$ miles northwest of Bridgetown black muck 2 feet thick is underlain by gray sand. This area supports a growth of cedar, bay, maple, and swamp huckleberry. In an area west of Pecks Corner the surface soil of muck and mucky black sand is underlain by gray sand which grades downward to almost white sand. In addition to timber this land produces ornamental holly, red maple, white cedar, and swamp magnolia, and an underbrush of sumac, marsh alder, fern grass, mosses, rushes, and sedges. Swamp has no agricultural value at present, except in a few places where efforts are made to grow cranberries. In some places the swamp is valuable for the white cedar growth on it.

COASTAL BEACH

Coastal beach consists of clean loose sand lying immediately along the water front. Much of this land is covered at high tide and is frequently swept by waves. It has no agricultural value and is largely bare of vegetation.

SUMMARY

The Salem area is in southwestern New Jersey and has an area of 527 square miles, or 337,280 acres. It is of comparatively low relief, the surface varying from flat to undulating or steeply rolling. The altitude ranges from sea level to more than 150 feet above. The general slope is toward Delaware River and Delaware Bay. Delaware River receives the greater part of the drainage of the area.

One of the first colonies was established in the Salem area in 1637 by the Swedes. The Swedish claim was relinquished to the Dutch in 1655 and they, in turn, relinquished it in favor of the English in 1664. Great numbers of Italians, Irish, Germans, and Russians have been added to this early population of Swedes, Dutch, and English. There are a number of colored people, some of whom are descendants of slaves who were employed on the plantations in southern New

Jersey prior to the Civil War. In recent years a great many people attracted by the lumber, maritime, and agricultural possibilities have moved into this part of the State.

According to the last census report, Gloucester County had a population of 48,224, with a density of 104.5 persons to the square mile. Cumberland County had a population of 61,348, with a density of 51.1 to the square mile. Salem County had a total population of 36,572, and a density of 67.3 persons to the square mile.

The Salem area has excellent railroad facilities, gravel and concrete highways, and considerable use is being made of the larger streams to transport produce.

The climate is temperate and much milder than its latitude would seem to indicate, probably because of the moderating influence of Delaware River, Delaware Bay, and the Atlantic Ocean. The frost-free season is about 184 days; the rainfall is adequate, and the humidity is relatively high.

The agriculture in the area consists of general farming, supplemented by dairying and market gardening. At the present time truck gardening is important, particularly in those sections where land values are high and where the soil is adapted to those products, and in areas near railroads or within commuting distance of cities.

In this area of comparatively low relief the upland surfaces are level enough so that most crops can be economically produced, as all kinds of labor-saving machinery can be utilized. On the other hand, there is a considerable proportion of poorly or imperfectly drained land where production of farm crops is prohibited or restricted.

This area is further favored by a great diversity of soil textures and soil conditions. A very intensive type of agriculture has been developed and made necessary by the ever-increasing land values. Under this condition a great deal of attention is given to the adaptation of soil and crops.

The well-drained graveley sands, coarse sands, sands, and loamy sands of the Sassafras, Colts Neck, and Collington series are recognized as excellent soils for the production of early truck crops. For the same crops, the deep phases of the Sassafras, Collington, and Keyport sandy loams are also considered valuable. The sandy loams of the Sassafras, Collington, and Keyport series produce mid-season or late truck crops, general farm crops, or special crops. The fine sandy loams of the Sassafras and Collington series are best adapted to the production of potatoes and general farm crops. Sassafras loam, Collington loam, and Keyport loam are more generally used for dairy farming or the production of general farm crops. Sassafras silt loam, and Keyport silt loam are utilized for general farm crops. In places on these soils potatoes are special crops. The gravelly phases of the loam and sandy loam members of the Sassafras and Collington series are considered valuable for the production of fruit.

The soils of the Elkton, Alloway, Portsmouth, Shrewsbury, and Keansburg series have very restricted agricultural possibilities on account of inadequate drainage but are valuable in affording pasturage for livestock. In the more remote or more inaccessible parts of the area, general farm crops are produced on all soils, irrespective of their particular adaptation, or the soils are used for such special crops as can be hauled to market at the convenience of the producer.

The soils of the Salem area are characteristic of that section of the country known as the Atlantic coastal plain. They are derived from unconsolidated beds of sand, sandy clay, marl, and gravel. In mapping, the soils have been grouped in 11 series which comprise 32 types and 9 phases. Broadly, they may be classified into three general groups, well-drained, imperfectly drained, and poorly drained soils. In the first group are representative types of the Sassafras, Collington, and Colts Neck series. In the second group are representative types of the Woodstown, Elkton, Alloway, Keansburg, Shrewsbury, and Keyport series, phases of the Sassafras and Collington series, and reclaimed tidal marsh. In the last group are representative types of the Portsmouth and Freneau series, and also the conditions known as swamp and meadow.



[PUBLIC RESOLUTION—No. 9.]

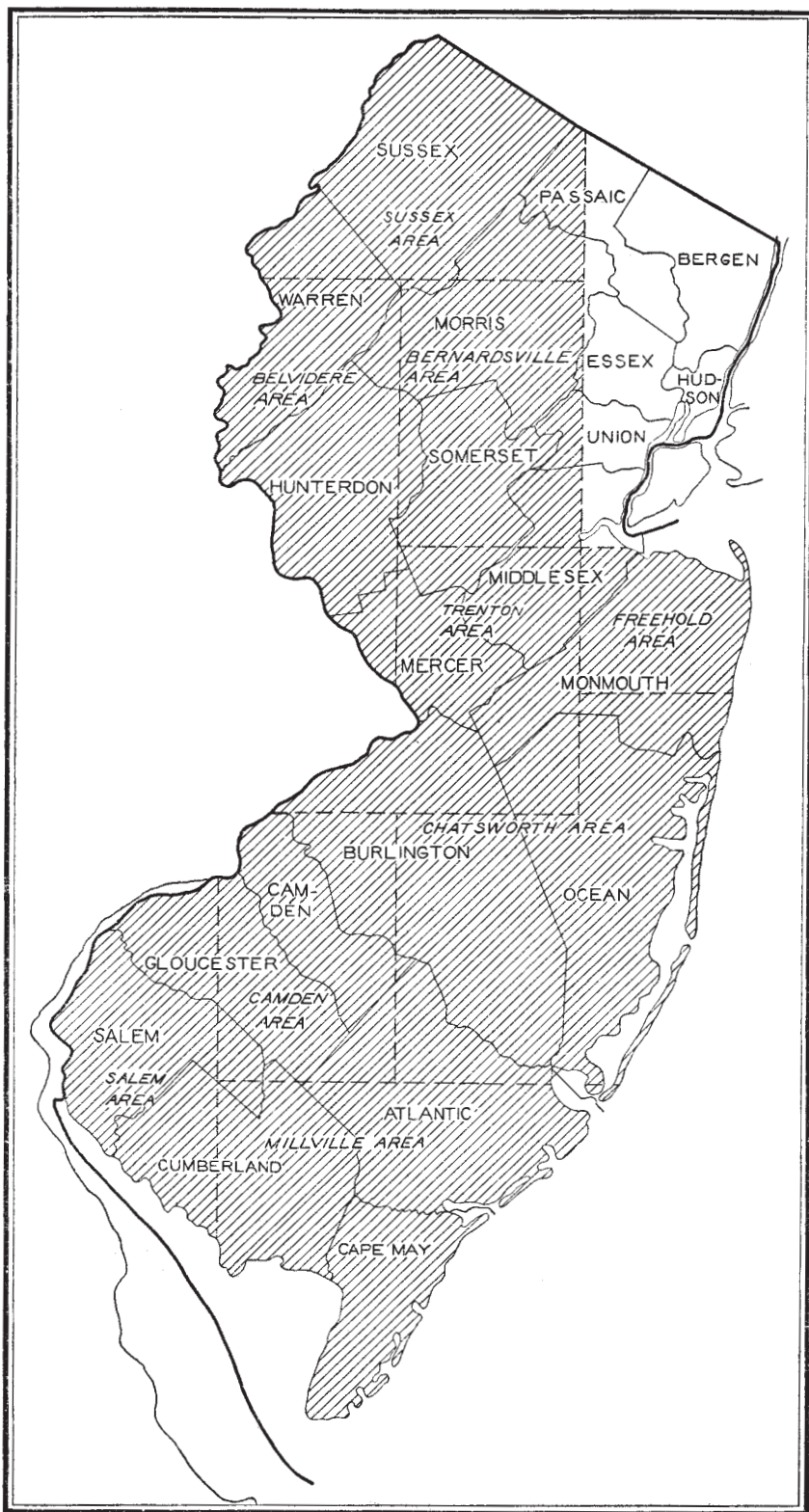
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, that in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in New Jersey, shown by shading

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